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STRATEGIC INTERVENTION AND READING COMPREHENSION MONITORING

by

© MICHAEL E. LUPART

A THESIS

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DEDICATION

To Judy for her continuous understanding, patience and support and to Vanessa and Michael for their contributions to the overall richness of this endeavour.

ABSTRACT

Reading comprehension as an epiphenomenon of cognitive activity involves the complex encounter between the reader and the text. An essential aspect of comprehending is the reader's monitoring of this complex cognitive activity. The intent of this investigation was the examination of this process in general, with emphasis on the nature of the strategic action initiated by the reader to resolve comprehension difficulty. More specifically, the major focus of this research was to examine the strategies and patterns of strategies utilized by college readers to resolve comprehension difficulties. An additional attempt was also made to examine the nature of the comprehension difficulties and the extent to which strategic intervention contributes to both the successful resolution of the comprehension difficulty and criterial task performance.

The study involved 21 adult college readers who each participated in four reading conditions, Reading Recall (C1), Reading Concurrent Verbalization Recall (C2), Reading Cloze Recall (C3), and Reading Cloze Concurrent Verbalization (C4). The expository materials used in these conditions were selected and adapted from third and fourth year level college texts.

Analysis of the data revealed that the participants identified obstacles to understanding which reflected ideational, relational and mnemonic difficulties. In response to these difficulties participants demonstrated a variety of patterns of remedial action. These consisted of Text Dependent, Text Dependent Interactional, Reader Dependent, Reader Dependent Interactional, and

Multi-Interactional patterns of remedial action. The Multi-Interactional pattern of remedial action was most highly associated with both the successful resolution of the comprehension difficulty and criterial task performance.

What was clearly evident in this study was that the recognition of comprehension difficulty alone was not associated with recall performance. Ultimately the nature of the remedial action initiated in response to the difficulty was most highly associated with criterial task performance. Furthermore, minimal criterial task performance difference (recall and cloze performance) across conditions suggests that concurrent verbalization, if used in a highly analytical reading situation, may not interfere with text processing. It was concluded that the comprehension monitoring process continues to be a fruitful area of investigation and it is evident that many questions remain. Possible directions for future research are suggested.

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Chapter I

INTRODUCTION

Over the course of this century the study of reading has undergone a multitude of changes. We have been strongly influenced by early theorists and researchers such as Huey (1908) and Thorndyke (1917) who helped sensitize the field to the notion of reading as a developmental and dynamic cognitive process. Indeed, the more recent trends in reading research and related areas are rooted in this early-century framework. This influence has not been continuously recognized over the course of the century but rather has only recently reemerged and has been advanced and developed most readily in the last decade.

This recent development can be attributed to the considerable efforts made to establish an in-depth knowledge base of reading comprehension. A majority of present-day theorists and researchers tend to regard the comprehending of text as an epiphenomenon of cognitive activity which occurs through the encounters between the reader and text. The activity is actualized through the generation of emergent understandings and interpretations. Consequently the reader's response to text is varied, dynamic and evolving. These encounters are controlled through varying degrees by both the reader and text. The text evokes in the reader a host of expectations which serve to structure, develop, embellish and elaborate the reader's thoughts. The reader brings to this situation a multitude of knowledge, experiences, processes, and actions all of which to a greater or lesser degree determine the quality of the encounters.

An essential aspect of comprehending recognized by both traditional researchers and theoreticians (Huey, 1908; Thorndyke, 1917; Dewey and Bently, 1949) and more recently by Goodman (1976), Ruddell (1976), Brown (1980) and Flavell (1981) is the reader's monitoring of this complex cognitive activity.

Although aspects of this process, particularly whether or not readers recognize comprehension failure, have been investigated, the patterns of remedial action readers use to resolve comprehension difficulties and how these forms of action relate to the resolution of the comprehension difficulty and comprehension performance have yet to be more fully examined.

Specific Purpose of the Study

The primary purpose of this research is to examine the strategies and patterns of strategies utilized by college readers to resolve comprehension failure. In addition, an attempt will also be made to examine the nature of the comprehension failures and the extent to which strategic intervention contributes to both the successful resolution of the comprehension failure and criterial task performance.

Research Questions

The following questions served as a guideline for the study. Question one defines the primary focus and purpose of the study, and the remaining questions are peripherally related to the study.

1. What spontaneous strategies and patterns of strategies are utilized by adult readers to resolve perceived comprehension difficulties?

    1.1 What is the relationship between the nature of strategic application and successful resolution of the comprehension difficulty?

    1.2 What is the relationship between strategic application and recall performance?

2. What is the relationship between recognition and nonrecognition of comprehension difficulty and recall performance?

3. What are the types of comprehension difficulties identified by the participants?

4. How do different reading situations affect strategy utilization?

    4.1 How does concurrent verbalization affect cloze and recall performance?

5. What is the relationship between strategic application and cloze performance?

6. What are the general study procedures spontaneously used by the participants and how might these procedures affect recall performance?

Definition of Terms

Although many of the terms which have been utilized in this study have been defined ostensively within the literature, there is some variation with respect to how these terms are interpreted and applied. For this reason, brief summaries of the more pertinent definitions will be presented in this section. Aspects of these definitions will be delineated further in subsequent sections of the dissertation.

Comprehending of Text

Comprehending of text is an epiphenomenon of cognitive activity and occurs through the encounters between reader and text. This process is actualized through the generation of emergent understandings. In this study aspects and interpretations of comprehending and comprehension will be operationalized through performance on the cloze and recall tasks.

Comprehension Monitoring

Comprehension monitoring is a process involving cognitive and metacognitive experience, knowledge, goals and strategies. These aspects are to a greater or lesser degree utilized by the reader to (1) recognize comprehension failure has occurred, (2) decide whether or not to attempt a resolution of the failure, (3) select and implement appropriate remedial actions, and (4) decide whether or not the action was successful and the difficulty was resolved.

Monitoring Strategies

Monitoring strategies are global and specific actions initiated and implemented by the reader in an attempt to remediate comprehension failures.

Symbolic Notation

For the purpose of clarity and brevity, the following symbolic notation will be used in this report.

C1	Condition one: Reading Recall
C2	Condition two: Reading Concurrent Verbalization Recall
C3	Condition three: Reading Cloze Recall
C4	Condition four: Reading Cloze Concurrent Verbalization
P1	Passage 1: The Functions of Language
P2	Passage 2: The Development of Thinking
P3	Passage 3: Kinds of Variance
P4	Passage 4: Types of Learning
Pr1	Practice Passage 1: The Scientific Process
Pr2	Practice Passage 2: The Quest for Equilibrium
Par	Participant

The above notations were at times combined to refer to a specific reading situation. For example, P2C4 would refer to Passage 2 being used in Condition 4.

Reference to specific responses by a participant in a certain condition involving a specific passage is indicated by combining the notations as follows: Par 21 P4C4 would refer to participant number 21 in a reading situation involving Passage 4 and Condition 4.

Overview of the Study

The main study involved 21 first year college students who each participated in four primary reading conditions:

Reading Recall (C1). The participant was required to read the passage silently and upon completion provided a recall of the passage.

Reading Concurrent Verbalization Recall (C2). Two sessions were used in the condition: an initial observation and practice session and a main session. In each session the participant read the passage, verbalized concurrently (think aloud) and upon completion provided a recall of the passage.

Reading Cloze Recall (C3). The participant was required to read the text, insert the appropriate cloze responses and upon completion provide a recall of the passage.

Reading Concurrent Verbalization Cloze Recall (C4). Two sessions were used in this condition: an initial observation and practice session and a main session. In each session the participant read the passage, inserted the appropriate cloze response, verbalized concurrently (think aloud) and upon completion provided a recall of the passage.

Non-narrative, expository cloze and noncloze texts of approximately 750 words in length were used and all passages and conditions were randomized.

Limitations of the Study

Although an attempt was made to select material that would have some relevance for the participants, the relevance accrued to the texts by the participants may have differed considerably. Furthermore, some of the texts may have been conceptually too demanding for some of the subjects. This may have contributed to frustration and a breakdown in strategic use. The conceptualization of the criterial task could have also been a factor here. Completing a task for the purpose of remembering information from a text may have been viewed as less important than if the information was to be remembered for the purpose of an examination or the solving of a relevant problem. It is conceivable that greater cognitive effort will be accrued to text if the purpose for reading the text is related to a criterial task which is relevant to the reader. Possibly self-selection of material within a specific course over a period of time may have made the learning situation even more meaningful and relevant for the participants.

Participants were informed that they would be required to understand and remember the textual information. However, because of the highly intuitive nature of individual criteria for understanding and remembering, the nature of these criteria for each participant was difficult to determine. Essentially what is meant by understanding and remembering by participants differs considerably and only began to emerge in this study. This remained very much a part of the tacit dimension. At present it would appear that what is important to remember and understand is dependent upon the participant's subjective interpretation of the criterial task.

Although attempts were made in this study, particularly through the use of the cloze procedure, to assess more clearly the extent to which remedial action would relate to the resolution of the comprehension failure, this was difficult to determine, particularly for relational and mnemonic difficulties. Participants felt they knew when the difficulty was resolved but how they knew could not be clearly articulated. In some cases it is conceivable the participant may have just stopped and moved on. The difficulty in determining whether or not the difficulty was resolved also contributed to more tentative statements as to how successful monitoring led to and contributed to comprehension performance.

Due to the nature of the concurrent verbalization tasks, in which participants were encouraged to stop at the end of each sentence and think aloud, participants may have been required to place significance on certain ideas when in actuality they would not have considered these as very important. Essentially, participants may have been encouraged to process information they would not have processed under the nonverbalization reading situations.

Implications of the Study

This study has a number of implications. The theoretical position outlined and the research reviewed can provide us with a more integrated framework from which to examine the complex monitoring process. More specifically, the patterns of remedial action identified can serve as a basis for further research. Instructional implications are as yet uncertain. However, if we assume that insights into pedagogy and the teaching of reading can be gained by observing what more successful readers do, and the observations are fairly representative of what is actually being done by the more successful readers, then the patterns of remedial action identified in this study may have some implication as a possible source of knowledge. Essentially, by observing what proficient readers do we can gain some insights into what less proficient readers are not doing, and possibly can provide these less successful individuals with some useful strategic alternatives. However, because the relationship between strategic use and comprehension success is not clear, and because strategic effectiveness depends on how the strategy is used and for what purpose, it is important that the strategies are presented as alternatives and are not rigidly imposed on the reader.

Methodologically this investigation may possibly contribute to a refinement of the concurrent verbalization procedure, particularly in its use in the investigation of the monitoring process. Through the use of an initial observation and practice session, ideosyncratic indication of monitoring can be identified. As a researcher, developing an awareness of these indicators of interruptions can be more appropriately timed, and inappropriate interruptions can be reduced to a minimum.

Organization of the Report

The chapter which follows will present a theoretical position and research related to the research questions, methodology and the outlined theoretical stance. Chapter III will present and discuss the design of the study, and Chapter IV will outline and discuss how the data were analyzed. The findings of the study and discussion related to both the theoretical position and relevant research will be presented in Chapter V. The final chapter, Chapter VI, will present and discuss the main findings, conclusions and implications for further research.

Chapter II

REVIEW OF THE LITERATURE

Introduction

The purpose of this chapter is to present both a theoretical position of comprehension monitoring and relevant research related to this position. Since the focus of this study is on how readers monitor their comprehension, the strategic aspect of the theoretical position will be of primary concern in this chapter. Following the presentation and discussion of the theoretical position, specific research related to the theoretical position in general and strategic action in particular will be presented. In addition to the examination of the literature to support the theoretical position, the literature will also be examined in terms of the methodological approaches used by previous researchers. The examination of the literature in terms of the methodological orientation is important because the methodology used will to a certain extent determine the nature of the questions that can be addressed and the data that are obtained. Seven methodological orientations, ratings and predictions of understanding, oral reading, measures of behavioral correlates, error detection paradigms, retrospection, introspection and protocol analysis and the cloze procedures have been used by researchers in an attempt to reveal aspects of the monitoring process. These orientations, in conjunction with the related research, will be discussed in the second half of this chapter.

Theoretical Position

Comprehension monitoring concerns the reader's ability to evaluate his or her ongoing comprehension processes while interacting with text, and to assume some form of remedial action if comprehension fails (Anderson, 1981; Alessi, Anderson and Goetz, 1979). The framework to be described in this chapter is an adaptation of both Flavell's (1981, 1979) theoretical orientation and the framework outlined by Alessi, Anderson and Goetz (1979). Initially the discussion of this chapter will focus on the framework presented by Flavell (1981). Following this major discussion, the framework presented by Alessi, Anderson and Goetz (1979) will be presented and integrated with the viewpoint proposed by Flavell.

Comprehension Monitoring: Knowledge, Experience, Actions and Goals

According to Flavell (1981), comprehension monitoring is a process comprised of four aspects: knowledge, experience, actions and goals.

Knowledge refers to what readers know about their own cognitive functions and is comprised of sensitivity, person variables, task variables, and strategies. Experience refers to any conscious cognitive or affective sense, and actions refer to the host of strategies the reader can utilize to assess and further comprehension. The final component is the explicit or implicit objectives that serve to instigate and maintain the cognitive enterprise. For a diagrammatic representation of this theoretical stance see Figure 1. Following a

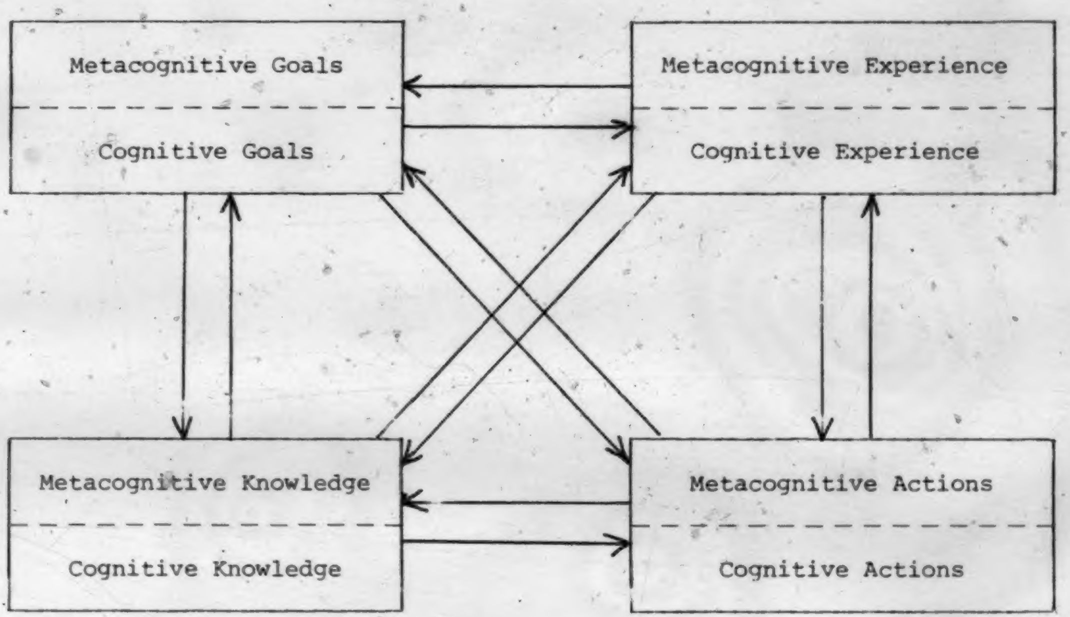
Metacognitive Goals
Cognitive Goals
Metacognitive Experience
Cognitive Experience
Metacognitive Knowledge
Cognitive Knowledge
Metacognitive Actions
Cognitive Actions

Figure 1

A Diagrammatic Representation of Comprehension Monitoring
(Flavell, 1981)

brief introduction to the notions of cognition and metacognition, these four primary aspects and their interrelationship will be further discussed.

Although there are several views and definitions of cognition and metacognition in the literature (Brown, 1975, 1977, 1978, 1980; Kail, 1979; Flavell, 1978, 1979, 1981; Flavell and Wellman, 1977; Forrest and Waller, 1979, 1980; Baker and Brown, 1984), for purposes of this study the following definitions will be adopted. Cognition refers to the actual knowledge, goals, experiences, and strategies that are utilized by the reader to further the aquisition of knowledge, while metacognition refers to (1) the reader's conscious knowledge about his or her cognitions and (2) the reader's conscious control of these cognitions to assess and further cognition. Consciousness refers to the reader's ability to discuss, talk about, or give some indication of his/her awareness of personal cognitive processing.

Knowledge

Metacognitive and cognitive knowledge, the first major aspect of the comprehension monitoring framework, is comprised of sensitivity, person variables, task variables, and strategies (Flavell and Wellman, 1977). As competent readers we become sensitive to what Craik and Lockhart (1972) and Anderson and Armbruster (1980) suggest is cognitive processing which is appropriate in kind and depth to certain reading situations. Essentially, the reader can flexibly control the ongoing cognitive processing to suit the self-determined requirements of the immediate reading situation.

As outlined by Flavell and Wellman (1977), the second component of cognitive knowledge, person variables, consists of the reader's sensitivity to intra-individual differences (e.g., I can remember more if I write down main points, rather than just repeat the main points as I read), interindividual differences (e.g., Some people may learn more through reading and notetaking rather than just reading) and universals. Universals refer to commonly held viewpoints by a community of readers. For instance, the viewpoint that there are various kinds of understandings and that these kinds of understandings are interchangeably employed as a function of the purpose for reading and text is a commonly held view. Essentially then, such intuitions assist in defining the reader's concept of him or herself as a reader.

According to Flavell (1981), the task variables, the third component of cognitive knowledge, are concerned with the nature of the information in the cognitive enterprise (e.g., familiar, unfamiliar, well or poorly organized, and presented under distracting conditions or not) and knowledge of task demands. Through knowledge of task demands the reader becomes aware that he or she may process information differently depending upon the criterial task or response to text required.

The final component, strategy variables, refers to our stored knowledge about the nature and utility of certain strategies which can be relied upon to interpret and understand text.

Experience

The second major aspect of the monitoring process, cognitive and metacognitive experiences, refers to the reader's conscious cognitive or affective experience (Flavell, 1981). Metacognitive experiences can have very important effects on the first component, metacognitive knowledge.

Metacognitive experiences and metacognitive knowledge are related to the extent that metacognitive experiences can develop and modify metacognitive knowledge. Experiences such as feelings of puzzlement or failure can lead to a change in cognitive and metacognitive goals and as Flavell (1981) purports, a change in the nature of cognitive and metacognitive strategic intervention. For example, a reader may sense (metacognitive experience) that he does not understand a particular section in text well enough to pass a subsequent exam. Consequently the reader reads the selection through once more. This is an example of a cognitive strategy (cognitive action) aimed at the cognitive goal of improving knowledge. In this case the reader is internalizing information from the text.

An example of a metacognitive strategy aimed at the metacognitive goal of assessing knowledge and generating another metacognitive experience is illustrated in the following: A reader may wonder (metacognitive experience) if he understands a section of text well enough to pass an exam. To reduce the bewilderment, the reader decides to ask himself some questions (metacognitive strategy) and checks how well he answers them (metacognitive experience).

Essentially, the use of metacognitive strategies to assess knowledge leads to metacognitive goals and experiences, while the use of cognitive strategies to improve his knowledge leads to cognitive goals and experiences. However, the same strategy may be evoked for either purpose (cognitive and metacognitive). The distinction is a difficult one to make, however the following example may serve to clarify how a strategy might be applied to both goals.

The reader could be reading a text for purposes of completing an essay exam. However, the reader is also fascinated by the text and wishes to understand more. At this point the reader senses a feeling of puzzlement and decides to check his understanding of the text. He decides to map out the passages and checks back to see how well his map corresponds with the text. To reiterate the above situation using Flavell's (1981) framework, the reader read the text with the deliberate aim of completing an essay exam successfully. However, while reading the text for this purpose, the reader reached an obstacle (was not sure of his understanding) which was signalled by a feeling of bewilderment. This is a metacognitive experience. The reader then utilizes a strategy to assess his understanding. However, the reader also utilizes the strategy to further understanding. Consequently, the activity is both cognitive and metacognitive. Through the application of this strategy the reader achieves the metacognitive goal of assessing his understanding but he simultaneously achieves the cognitive goal of furthering his understanding. In both cases the metacognitive experience of satisfaction was generated and the strategy both assessed and furthered knowledge.

In view of the above example, one might be led to query when does metacognitive experience become metacognitive knowledge? Flavell (1979) would suggest that, for the most part, metacognitive experience is metacognitive knowledge that has entered consciousness. For instance, the feeling that you are far from a goal is not in itself a component of metacognitive knowledge. How you interpret that feeling and how you decide to resolve this dilemma will undoubtedly be guided by your metacognitive knowledge. Essentially, some experiences may have metacognitive knowledge as their content while others may not. Furthermore, as noted by Flavell (1979), some knowledge may become conscious and comprise such experiences and some knowledge may not.

This leads us logically to further pose the question, When does metacognitive knowledge become conscious? or as Flavell (1981) suggests, When are metacognitive experiences most likely to occur? Metacognitive experiences relate to our progress towards a goal of understanding in general and the operationalized criterial tasks or responses to text in particular. As long as the progress towards the goal of understanding is smooth and uninterrupted, the necessary metacognitive knowledge and strategies are utilized somewhat automatically (Brown, 1980, 1981). However, once feelings of uncertainty, ambivalence or other affective responses signal some difficulty in the normal progression, more conscious thought and attention may be required. Understandably, these experiences are more likely to occur if normal cognitive processing is interrupted. Langer (1978) notes that conscious cognition occurs when the situation necessitates that the individual thinks about and evaluates alternative courses of action (e.g., solve complex problems) and/or the individual is placed in a novel situation and is required to complete a task. This, of course, presupposes that the individual finds the cognitive enterprise relevant and the task is not too difficult. In the case of extreme difficulty the goal may be abandoned.

Actions

The third aspect of Flavell's (1981) concept of the monitoring process, actions or strategies, is utilized to further and assess cognitive progress. As it was described in the earlier section concerning metacognitive experience, the distinction between metacognitive strategies and cognitive strategies is likewise apparent here. If the actions are used in the service of monitoring progress they are viewed as metacognitive strategies, yielding metacognitive experiences and at times cognitive outcomes. However, if the actions are used to further cognitive progress, they are referred to as cognitive strategies and will yield cognitive outcomes as well as metacognitive experiences.

Several examples of such cognitive and metacognitive strategies have been reported in the recent literature. These include such activities as rereading (Garner and Reis, 1981), use of lookback (Alessi, Anderson and Goetz, 1979), looking forward to see if information will be consistent with, or can be predicted by present understanding (Markman, 1981), formation of a pending question (Collins, Brown and Larkin, 1980), referring to an expert source (Collins and Smith, 1980), mapping (Geva, 1981) and notetaking (Orlando, 1980). It is important to note that these actions are global procedures the reader may undertake to assess and further comprehension, and that they can differ qualitatively in their function and content. How these procedures are applied in the service of comprehension depends on the reader's metacognitive knowledge, metacognitive experience and how s/he views the criterial task (Brown, Campione and Day, 1981).

Whereas it is acknowledged that the above global procedures are pertinent to the cognitive actions component of the monitoring process, it is equally plausible that there be any number of other strategies that Flavell (1981) has not specifically outlined. For instance, Collins et al. (1980) and Phillips-Riggs (1981) found that in conjunction with pending questions, readers utilized a number of different inferring strategies to facilitate comprehension. The extent to which these strategies and others are involved in self-initiated and spontaneous monitoring procedures or activities would appear to be a useful area to pursue, particularly in light of the growing controversies concerning the effectiveness of these more global activities.

Goals

The final component of Flavell's (1981) framework of comprehension monitoring, cognitive and metacognitive goals, is the explicit or implicit objectives that instigate and maintain the cognitive enterprise. In a reading situation, particularly in an efferent encounter, these goals comprise both the aim and purpose of the encounter and tend to be operationalized as a criterial task (Brown, Campione and Day, 1981; Rosenblatt, 1978). However, these goals will likely be less clearly defined if the reading situation is principally an aesthetic encounter, in which case the reader would be reading for pleasure or for pure enjoyment. Reading researchers have widely acknowledged that the nature of the goal or criterion task will to a significant extent affect how the individual will process the text. For instance, Smith (1967) suggested that the nature of processing changes depending on whether the readers read for details as opposed to general impressions. His research showed that indeed this was the case for good readers, however the less proficient readers tended to be less sensitive to the task demands and varied their approach only slightly.

In corroboration, Fredericksen (1975) found that adult readers tend to process a passage very differently if required to read and form inferences for purposes of solving a problem, as opposed to reading to remember the passage.

It should be noted here that a critical aspect omitted by these researchers was how the reader viewed the criterial task. One cannot assume that the purpose imposed by the researcher is synonymous with the purpose or purposes selected by the reader. Furthermore, the reader's purpose for reading may change throughout the duration of the encounter, consequently the criterion for comprehension as determined by the reader's response to certain comprehension failure may also change. Possibly comprehension failure occurring at different levels (word, sentence, intersentence and passage) and the reader's sensitivity to factors which may contribute to comprehension failure (insufficient availability of prior knowledge and text ambiguity) may influence how a reader monitors his/her understanding of the text (Anderson, 1981; Collins and Smith, 1980).

Flavell (1979, 1981) has proposed a fairly comprehensive framework for the examination of the four crucial aspects of the monitoring process. However, further elaboration is required to account for how cognitive and metacognitive knowledge, experience, actions and goals are used by the reader to monitor comprehension. In an attempt to elucidate further this notion, the framework proposed by Alessi, Anderson and Goetz (1979) will be presented and integrated with the aspects of comprehension proposed by Flavell.

The Comprehension Monitoring Process

Alessi, Anderson and Goetz (1979) propose that to monitor comprehension the reader must (1) recognize comprehension failure has occurred, (2) decide whether or not to attempt to resolve the failure and (3) if warranted implement or initiate appropriate remedial action. Although not mentioned by these researchers, a fourth component in the process should be considered. Essentially, the reader should make a decision as to whether the action was successful and the difficulty was resolved.

It is proposed that cognitive and metacognitive goals, experience, knowledge and actions could be utilized by the reader to a greater or lesser degree in each of these components of the process. For example, recognizing comprehension failure has occurred could involve cognitive and metacognitive experience, knowledge, action and goals.

Essentially, a reader could recognize that failure exists through a feeling or sense of not understanding (cognitive and metacognitive experience). Cognitive and metacognitive knowledge could also relate at this point because the reader would have to utilize prior knowledge and experiences to determine the nature of the difficulty. The host of strategies or actions the reader may know to assess progress would also relate to cognitive and metacognitive knowledge, and how the individual may use these actions to assess progress would relate to cognitive and metacognitive action. The recognition of the significance of the comprehension difficulty would be influenced by the reader's knowledge of the criterial task or goal.

To illustrate further, a reader is preparing for an examination in which his knowledge of seven principles will be assessed. These seven principles are discussed in a text which the individual is presently reading. The reader is reading the text for the purpose (cognitive and metacognitive goal) of understanding the seven principles. However, as he progresses through the text he has a sense (cognitive and metacognitive experience) of not being able to remember these points. This was further confirmed when he attempted to write down the major principles and he could only recall one of the principles. Here the reader utilized both metacognitive knowledge (a strategy for assessment and personal criteria for knowing) and a metacognitive strategy (note taking in the service of assessing his understanding). The cognitive aspects of knowledge would serve as a resource base.

Deciding whether or not to attempt a resolution of the failure could also include cognitive and metacognitive knowledge, experience, action and goals. Referring to our previous illustration, the individual has decided that a comprehension difficulty exists. This was based on the reader's cognitive and metacognitive knowledge and goal that recalling one principle out of seven is inadequate. Knowing how to go about deciding whether or not to resolve the comprehension difficulty would involve some form of strategic action (cognitive and metacognitive action). The metacognitive experience in this instance would consist of the feeling of whether or not to resolve the comprehension difficulty.

Although cognitive and metacognitive knowledge, experience, goals and strategies would be involved in the implementation of remedial action, at this point the strategic aspect would be of primary concern. The strategic aspect would be both cognitive and metacognitive. The reader would possibly examine his repertoire of strategies and taking into account task variables (metacognitive knowledge) and criterial task (metacognitive goal) initiate remedial action. How the individual arrived at the decision of remedial action would involve metacognitive action because different possible actions would have to be assessed (e.g., mapping, outlining and rereading). However, the actual application of the action would be cognitive because the action would be used to further understanding as opposed to the assessment of understanding. The process at this point would also be highly interactive. For instance, the reader may have decided to use rereading as a strategy but discovered that this was not sufficient. This relates directly to the fourth component: deciding whether or not the action was successful and the difficulty was resolved. Again cognitive and metacognitive knowledge, experience, goals and strategies would be involved. For instance, the reader may experience a sense of not having resolved the comprehension difficulty (cognitive and metacognitive experience). He decides to assess his knowledge by writing the main points from memory (metacognitive action). Again the assessment was conducted with reference to the criterial task (cognitive and metacognitive goal) and knowledge about himself as a reader (cognitive and metacognitive knowledge). During and upon completion of the self test the reader continued to have a sense of not knowing (metacognitive experience) and this was confirmed when he could only remember two out of the seven primary points. Metacognitive and cognitive knowledge would be a factor in deciding whether two out of seven was adequate to meet the criterial task. However, the reader may have decided that based on prior experience and view of himself (cognitive and metacognitive knowledge) and criterial task requirements this was not sufficient and the difficulty was not resolved. At this point the process could be repeated. Essentially the reader would have to recognize that a comprehension failure is still occurring and decide to attempt or not to attempt a resolution.

In summary, integrating the aspects of comprehension monitoring outlined by Flavell (1981) and Alessi, Anderson and Goetz (1979), comprehension monitoring is viewed as a process involving cognitive and metacognitive experience, knowledge, goals and strategies. These cognitive and metacognitive aspects are to a greater or lesser degree utilized by the reader to (1) recognize comprehension failure has occurred, (2) decide whether or not to attempt a resolution of the failure, (3) if warranted implement appropriate remedial action and (4) decide whether or not the action was successful and the difficulty was resolved.

The research that is pertinent to this theoretical position will be presented in the subsequent section. In the course of this presentation it will be posited that the strategic aspect of the framework, essentially how readers attempt to resolve comprehension difficulties, has not been adequately detailed or examined in the literature. Furthermore, questions related to (1) nature of comprehension difficulties, (2) the relationship between strategic utilization and successful resolution of the comprehension failure and

(3) the relationship between strategic utilization and criterial task performance require further investigation.

Review of Related Research

Evidence to support the notion of comprehension monitoring as an integral part of the reading process has been accrued through a variety of methodological approaches. These include ratings and predictions of understanding, oral reading, measures of behavioral correlates, error detection paradigms, retrospective approaches, introspection and protocol analysis and the cloze procedure.

Ratings and Prediction of Understanding

The rating of understanding paradigm involves the ability to predict accurately one's performance. By way of example, Flavell, Friedrichs and Hoyt (1976) found that nursery and kindergarten children tended to overestimate their recall ability while Kreutzer, Leonard and Flavell (1975) found that young children had difficulty estimating the complexity of the tasks. These patterns evident in list learning tasks are also apparent in studies involving narrative text.

In a study by Brown and Smiley (1977) subjects ranging in age from 8 to 18 were asked to rate and recall certain folk tales. Initially, the subjects listened to the story and read the stories simultaneously. One idea unit was presented per line. Following a second reading, the subjects were asked to rank the idea units into four groups, ranging from the least important to the most important. Comparisons with college student ratings (acquired in an earlier study) revealed a strong developmental trend (Brown and Smiley, 1977).

While the 18 year olds were able to distinguish all four levels of importance, the 12 year old subjects demonstrated a great deal of difficulty differentiating the second and third levels. Furthermore, the 10 year olds could only distinguish the highest level and 8 year old subjects were even less able to make distinctions. However, the insensitivity was not apparent in recall. A general pattern of results (level 4 < 3 < 2 < 1) was consistent across age levels.

Forrest and Waller (1979, 1980) in a study involving third and sixth grade poor, average and good readers, found that young children revealed little explicit awareness of comprehension monitoring. Children read two different stories for each of four purposes: (1) for fun, (2) to formulate a title, (3) to skim and (4) to study. Upon completion of the reading the children were given comprehension questions to answer and a metacomprehension test. The metacomprehension test required the children to provide confidence ratings on the correctness of their answers. Ability to predict comprehension accuracy successfully and adjust reading to meet the various demands of the comprehension task increased with age and competence.

Although these results suggest age and ability differences in the judgement of comprehension success, certain limitations in the use of the confidence rating technique should be noted. For instance, young children tend to respond to questions affirmatively, regardless of the truth of the assertion (Brown and Lawton, 1977; Brown and Campione, 1972; Brown and Scott, 1971). This positive response bias could have influenced Forrest and Waller's results, particularly with respect to the lower ability third grade students. A second limitation of this technique is the reader's assessment of understanding or misunderstanding is made after reading as opposed to during reading.

To use Raphael et al.'s (1981) work as an example, seventh grade readers were required to each read four versions of thirty-six narrative passages. The passages differed in level of familiarity, goodness of structure and vocabulary difficulty. Cognitive monitoring of understanding was assessed through subject performance on two dependent variables: (1) judgement of passage difficulty and (2) prediction of post test performance. Data analysis revealed judgement of passage difficulty and comprehension performance was positively related to topic familiarity and good story structure.

The point to be made here is that had Raphael et al. (1981) included some measure of the reader's assessment of understanding during the reading of the passages, the more interesting problem of why the subjects rated some passages as more difficult than others may have emerged.

This criticism can similarly be applied to research that requires subjects to make predictions about their performance. Alvermann and Ratekin (1982) found that seventh and eighth grade average readers could quite accurately predict performance on an essay or multiple choice exam and consequently take the necessary remedial action. For instance, students who perceived themselves as having low proficiency on these tasks reported "reading carefully/slowly" significantly more often than those subjects who perceived themselves as having higher proficiency. Unfortunately the authors' failure to assess understanding during reading limited their interpretation of results.

In total these studies do suggest that the assessment of criterial task performance is influenced by maturational factors. However, the explicit criteria for making the judgement by the participants were not revealed. Essentially the question remains, how did the participants know they would and did experience difficulty on the criterial task, and if they knew they experienced difficulty, what was the nature of the remedial action initiated by the participants in an attempt to more specifically meet the demands of the criterial task. Reading carefully/slowly as revealed by the Alverman and Ratekin (1982) study may be viewed as a possible form of remedial action, however how individuals view reading carefully/slowly and what individuals do when they read carefully and slowly may be potentially more revealing. Possibly reading situations in which participants verbalized their thoughts while completing the reading task may prove to be more informative.

Oral Reading

A second approach that has been utilized to examine comprehension monitoring is that of analysis of the oral reading behavior demonstrated by readers of varying proficiency and ages.

Goodman (1976) and Goodman and Burke (1980) initially proposed that readers make predictions and test hypotheses against screens of meaning and syntax by asking themselves if what they are reading makes sense. This psycholinguistic orientation utilizes an oral reading and miscue analysis procedure and has been widely used by researchers to examine the monitoring and self correction behavior of readers.

Kavale and Shreiner (1979) in a study involving sixth grade average and above average readers found that average readers were more likely to make meaning distortion errors and less likely to correct the errors that did occur, through the use of protocol analysis. The researchers noted that many of the oral reading errors of the above average readers were classified as semantically acceptable, and had not been self-corrected. This suggests the more proficient readers focused more on meaning than the decoding aspect of reading.

In another study of oral reading miscues, Canney and Winograd (1979) found that poor second, fourth and sixth grade readers tended to focus on the decoding aspect of reading while the more proficient sixth grade and all eighth grade readers appeared to realize meaning getting was the primary goal of reading.

This result was partially supported in a study by Paris and Meyers (1981). In this study fourth grade good and poor readers were presented with modified narrative passages. Each story was modified to include four anomalous words and phrases. The reported procedure of having students self correct and underline nonsense words and phrases is somewhat suspect, particularly if one assumes reading is a meaning getting process. However, the researchers did find that in many cases the poor readers failed to notice the anomalies and consequently engaged in significantly less monitoring.

The extent to which substitution miscues detracted from comprehension and reacall was the focus of a study by Beebe (1980). Although substitution errors tended to reduce comprehension and recall scores, some substitutions tended to affect criterial task performance more than others. Corrections and syntactically-semantically acceptable miscues affected test performance the least, while syntactically-semantically unacceptable miscues appeared to detract appreciably from both text understanding and recall.

O'Brien (1981) in a descriptive study involving adults learning to read, found that poor readers are by no means homogeneous in their reading strategies. Some of the readers utilized strategies characteristic of good readers. Of particular significance was the noted use of contextual information to monitor and self correct oral reading performance.

Both O'Brien (1981) and Wixson (1979) note that miscue patterns may vary as a function of instructional method and materials, and the interaction between the reader's prior knowledge, purpose for reading and structure and context of the reading material. This suggests that the analysis of oral reading miscues may have some validity as a research and assessment technique, particularly if other sources of evidence are considered. This approach may also be potentially revealing, particularly with reference to whether or not readers recognize that they are experiencing difficulty in their oral reading and whether or not they use grapho-phonemic, syntactic and semantic knowledge as an aid to possible remedial action. However, how and when readers may use this knowledge to remediate comprehension difficulty is still open to investigation. Oral reading data may prove useful particularly with less mature readers who are more likely to have proportionately greater oral as opposed to silent reading experiences in beginning reading instruction. In conclusion, since the focus of this study was on the college reader and since most of the reading experiences of these students were silent, this approach was not considered appropriate.

Measures of Behavioral Correlates

Another source of information about the monitoring process are measures of behavioral correlates. These measures include eye movements and other visual behavioral indices.

There is some evidence (Shebilske and Fisher, 1981) to suggest that readers spend more time on new and what they deem as important information, although this is not conclusive (Rayner, 1978). What is considered significant information depends, it would seem, on both the nature of the reading situation and the criterial task. However, in support of Shebilske and Fisher (1981), Rothkopf and Billington (1979), using college students and complete text, found that compared to incidental sentences, goal relevant sentences resulted in over twice as many fixations.

Research related to monitoring and eye-fixations tends to assume fixation duration is affected by the cognitive processing occurring during the time period of the fixation, consequently more difficult words and passages should lead to longer fixation durations.

Of interest to the issue of comprehension monitoring is the extent to which different error conditions affect visual processing. In a study conducted by Zola (1979) cited by McConkie and Zola (1981) college students read 10 paragraphs under each of 10 conditions (2 levels of constraints—high and low—by 5 levels of error). Levels of error ranged from a no error condition to a severe error condition in which the initial, fourth, and final letters were replaced. Compared to the no error condition, fixation duration, saccade length, and frequency of regressive movement were all appreciably higher in all other error conditions. As it would be expected, more extreme errors caused greater disruption in eye movements and subsequent reading patterns.

This brief review of the literature related to eye movements and fixation duration does appear to suggest that readers monitor what they read. However, considering the artificiality of the tasks and the nature of the text used, the notion of basing a theory of reading on eye fixation as outlined by Just and Carpenter (1980) is tenuous and certainly premature. Ultimately this technique may prove useful as one of the many converging indices that we can apply to infer how readers monitor comprehension.

Baker and Anderson (1982) similarly utilized an error detection paradigm; however, the errors consisted of meaningful words as opposed to spelling errors. In this study college students were presented with four descriptive informational passages, in which the supporting detail of the middle paragraph in each passage was inconsistent with the main topic of the passage. Each passage was presented sentence by sentence on a computer screen and subjects were permitted to reread prior sentences or the complete passage if they so wished. Subjects were informed they would be required to answer a series of multiple choice questions pertaining to the information read. Even though some subjects were alerted to the possibilities of inconsistencies in the passages, performance between the two groups was not affected. In both cases subjects spent more time on sentences containing information that conflicted with prior textual information.

In an attempt to determine the nature of the processing strategies utilized by the subjects, subject data records were reexamined for the sequence of sentence exposures. If subjects were exposed to a main point inconsistency, 31% immediately reread the preceding sentence. In contrast, if exposed to an inconsistent detail, only 16% of the subjects looked back at the preceding sentence. These findings support those reported by Alessi, Anderson and Goetz (1979) who found that lookbacks can serve as a useful strategy to remediate comprehension failures even if not initiated by the reader. However, a number of other questions remain. Essentially, how did the participants attempt to resolve comprehension difficulties through procedures other than lookbacks, and if lookbacks were used how did the nature of their lookbacks vary from one participant to the other? Possibly these concerns could be addressed through the use of additional techniques such as introspection and concurrent verbalization.

Another technique utilized by researchers to assess comprehension monitoring is the use of nonverbal indicators. A study which typifies this approach is reported by Patterson, Cosgrove and O'Brien (1980) who examined children at each of four age groups, 4, 6, 8, and 10 and presented them with oral messages differing in informational adequacy (information partially informative or uninformative). Although the nature of the criterial task was not clear, the children at each of the four ages differed markedly in their nonverbal behavior. Children at all ages showed more hand movement and longer reaction times when the messages were ambiguous. When coping with uninformative messages four year olds made more eye contact with the speaker, however body movement was unaffected. For six and eight year olds the reverse was true. In addition, the researcher found that when verbal responses were additionally requested these responses were added to the established patterns of nonverbal behavior.

Garner and Reis (1981) utilizing a textual format as opposed to an oral language procedure found nonverbal and verbal variations across both comprehension proficiency levels and grade levels. Essentially, sixth and seventh grade good comprehenders demonstrated monitoring behavior but failed to use lookbacks spontaneously, while eighth grade proficient comprehenders demonstrated monitoring and used lookbacks. On the other hand, poor, sixth, seventh and eighth grade comprehenders failed to demonstrate either monitoring or spontaneous use of lookbacks.

These studies of eye movements, lookbacks and other nonverbal behaviors indicate that readers, particularly college students and more proficient secondary students, are aware of the existence of comprehension difficulities and will attempt to utilize lookbacks in an attempt to resolve these difficulties.

This notion of examining nonverbal indicators of comprehension monitoring may prove useful in the present exploration of how college readers monitor their understanding of text. If we can assume that behaviors such as lookbacks, gestures, nods, frowns, long pauses may be indicators of comprehension difficulty and if these behaviors occurred, particularly in a concurrent verbalization reading situation, a researcher could probe to assess further the nature of the difficulty and the remedial action the reader may have or is intending to initiate.

Error Detection Paradigm

In an attempt to control the sections of discourse and text subjects may find confusing, and consequently to examine the ways in which individuals monitor their comprehension, numerous researchers have utilized the error detection paradigm. In this approach errors are deliberately placed in the passages and subject responses are examined to determine the effect the error may have had on the reader's processing and comprehension of the text.

In a preliminary investigation utilizing nontextual material Markman (1977) presented first, second and third grade students with instructions to complete a task. Some information was deliberately omitted, consequently the criterial task could not be completed successfully. In the listening condition all subjects required some probing before they noticed the inadequacy of the instructions. However, the extent of the probing differed for each grade group with the third graders requiring the least probing, and the first and second grade subjects requiring the most. Interestingly, if demonstrations of the tasks accompanied the instructions the children more readily indicated they had failed to understand. Markman (1977) suggests that this initial insensitivity to their own comprehension failure may be due to a lack of constructive processing. This would, of course, depend on the subjects' perceptions of the criterial task. For instance, if the subjects based their understanding on the comprehension of the simpler structures that comprise the more complex higher order structures, and if these simpler sentences contained the anomalies, then they would tend to overestimate how well they understood.

This was well exemplified in a later experiment in which third and sixth grade children were required to act as editors and listen to essays that contained both explicit and implicit contradictions (Markman, 1979). Although children were more likely to notice explicit than implicit contradictions, most of the children judged material as comprehensible even if the essays contained obvious inconsistencies. These findings suggest that children may tend to evaluate their performance in a piecemeal fashion, focusing on individual sentences as opposed to evaluating the higher order relationships in text.

Similar findings have been reported by Pace (1979). In this study 84 children were presented with two stories about familiar events. One story was consistent with the children's scripts, while the other story contained script-inconsistent information. Twelve children in each of grades 2, 4 and 6 read the stories while 12 other children in kindergarten and each of grades 2, 4 and 6 listened to the stories. All subjects were questioned immediately and also recalled the story information one week later. Equivalent proportions of participants detected the inconsistency initially and during recall, and the recall of script consistent information was better than the recall of script inconsistent stories. Of primary interest was the finding that listeners had more difficulty noticing inconsistencies than the readers. Perhaps it is the greater reliance on the abstraction and structure of the text that may make violations more obvious to readers. However, it should also be noted that many readers failed to notice or report the script inconsistent information.

Not entirely in support of the above interpretation of the findings, Wimmer (1979) suggests that ability to deal with script inconsistent information may not be purely a matter of a deficit in spontaneous conceptual processing, but may be more a matter of a wrong initial representation of the violated script entry condition. In this study, four and six year olds were required to evaluate the possibility of a situation occurring in which a story character, Suzi, was required to purchase some groceries. On her way to the supermarket Suzi lost the wallet, and upon having to pay for the groceries she took the wallet from the basket and paid the cashier. Initially none of the four year olds and only 50% of the six year olds were able to recognize the inconsistency. However, if required to recognize the entry condition (paying is impossible without the wallet), performance for the four year olds increased to 60% and for the six year olds performance increased to 100%.

It seems logical to suggest that what may be a critical factor is the extent to which young children may spontaneously draw the relevant inferences and note the script violations. This was indeed examined in a follow-up study by Markman (1979) in which third and sixth grade children were encouraged to identify the inconsistent information. Children who received the set instructions performed significantly better than individuals who were not informed of the inconsistency. Essentially, children who expected to find a problem questioned the truth of statements far more frequently than children without the expectations.

Possibly the ability to monitor comprehension is facilitated when the criteria for evaluating one's understanding are more explicit. For instance, Pace (1980) found that both second graders and kindergarten subjects corrected their responses to questions if given the opportunity to do so. However, this aspect has not been examined in any depth, and it would seem appropriate to suggest there is a need for research in which subjects' perception of the criterial task is taken into consideration.

In a more recent investigation, Reis and Spekman (1983) presented sixth and seventh grade poor comprehenders with passages containing text-based and reader-based inconsistencies. Text-based inconsistencies involved minor infractions while reader-based inconsistencies were linked to the reader's general understanding of the text, and involved major violations of reality. The findings indicated that these less proficient comprehenders could detect and correct reader-based inconsistencies to a significantly greater degree than the text-based inconsistencies. However, this research does not appear to be consistent with the findings from earlier studies. For example, Garner (1981) presented 20 grade five poor comprehenders with three short passages: one informationally consistent, one informationally inconsistent and one containing polysyllabic modifying words. The subjects rated the modified word passage as much less comprehensible than the other two. What is of significance here is that the poor comprehenders rated informationally consistent and informationally inconsistent passages as equally comprehensible. It would appear that even though subjects are more likely to detect inconsistencies when they are in text as opposed to speech, some readers, particularly poor comprehenders, may only process the text in a surface fashion and consequently overlook the higher level text inconsistencies. Unfortunately in the Garner (1981) study, the subjects were not interviewed as to why they ranked passages the way they did. Furthermore, in both of their investigations no observations were conducted as to the reason or purpose they may have had for reading the material. This is an area that is consistently overlooked by researchers utilizing an error detection paradigm. Clearly the extent to which certain text deviations are tolerated by readers depends upon how they perceive the criterial task. For instance, if a reader reads only for gist, minor text infractions, such as inconsistent supporting details, may not be viewed as significantly affecting understanding or performance on the criterion task.

The problems apparent in the above studies were partially overcome in the alternate approach suggested by Garner (1980). In this study more proficient and less proficient junior high readers were directed to examine two expository passages as editors. Again subjects were required to rate chunks of the passages as easy to understand, okay, or difficult to understand. However, subjects were also required to provide a justification for the ratings, particularly the latter two. Subject responses differed both quantitatively and qualitatively. Good readers tended to notice the disruptive effect of the altered material far more frequently than the less proficient readers. Furthermore, the more proficient comprehenders were also more likely to utilize the text inconsistent information to support their ranking than the less proficient readers.

In corroboration Winograd and Johnson (1980) attempted to examine the extent to which more proficient and less proficient sixth grade readers monitor comprehension through the selection of appropriate schemata. Subjects were assigned to either a preparation (schemata activation) or a nonpreparation (nonschemata activation) condition. Preparation consisted of a production task in which the subjects were presented with a picture, directly related to the reading passage, and were required to discuss the picture. In the no preparation condition the children were required to read a word list comprised of the words in the passage. Again as in the Garner (1980) and Markman (1979) studies the children were asked to act as consultants in determining the comprehensibility of the passages. The children's views of what a consultant may do in this situation was not examined.

Although sixth grade more proficient readers detected significantly more of the errors than the less proficient readers, a surprising number of the children failed to report some very obvious errors. Only 56% of the good readers and 18% of the less proficient readers noted all four errors. No evidence was found that would suggest that schema activation would significantly improve poor readers' error detection performance.

Although the use of an "editorial" directive in the above study may have been useful (particularly when we consider that most students are unwilling to admit comprehension problems to an adult in a school setting), the procedure may have been far more effective if subjects would have been encouraged to edit the material to make the text more comprehensible. This may also facilitate a check on how they view their role as an editor (i.e., look for inconsistencies in concept of wording). Consequently, a more indepth qualitative analysis of the subject responses would have been possible.

More relevant to the present research are those error detection paradigm studies using adult or college level subjects. In a study involving college readers Baker (1979) asked the subjects to read expository passages that contained intentionally introduced confusions. The confusions were of three types: (1) inconsistent information, in which the ideas in one sentence conflicted with the ideas of another; (2) unclear reference, where the noun referent was ambiguous; (3) inappropriate logical connective, where the expectations about the nature of information following a particular connective was inconsistent. The inclusion of these confusions was varied to either include main points or details.

The six passages were presented in a single booklet along with the complete instructions. All subjects were required to complete three parts, study, probed recall, and detection. The study was conducted in a group setting and all the subjects were required to write their responses.

The initial error detection rate was 23% and even if subjects were informed that confusions were present the detection rate only increased to 38%. Although subjects tested the consistency of the ideas with one another, they focused more on the concepts themselves rather than on the way they were logically connected in the text. After examining the subjects' probed recalls and the retrospective responses, Baker (1979) found that subjects often used unconscious fix-up procedures to resolve the potential confusion. This procedure included the use of prior knowledge to supplement explicitly presented information and the formation of alternate interpretations of the text. The more content-free decisions and behaviors consisted of rereading previously read information; to check if some crucial information had been overlooked; and making a mental note that the problem had arisen, but to continue reading and looking for clarification in the later part of the text. Furthermore, many readers decided that, considering their reading purpose, the problem was trivial and not worth the effort of trying to resolve.

These findings suggest that reports of text confusions may not in themselves be a very sensitive index of comprehension monitoring. Essentially, in addition to knowing whether or not a confusion was detected, one must also know how extensively the text was processed and interpreted. This further suggests that the question of most interest is not whether readers monitor their understanding of text but rather how they monitor it. In direct support of this Winograd and Johnston (1980) contend that the greatest criticism of the error detection paradigm is that it leaves the question unanswered, "Did the subjects fail to detect the errors or did they detect the errors but fail to mention them?" As the research suggests there may be numerous other explanations as to why subjects fail to mention certain text inconsistencies. For instance, Markman (1979) found children may just fail to recall the inconsistent information, or may lack the logical competence to make the necessary inferences. Subjects may also hesitate to criticize the experimenter, consequently the need for subjects to act as editors was initiated. Furthermore, as discussed by Baker (1979), subjects may not report errors because they may utilize prior knowledge to supplement the information, may assign alternate interpretations to the text, assume the writer has made an error and ignore it, or ignore the error for the time being and assume subsequent information may resolve the inconsistency. Other factors such as lack of prior knowledge, suspension of disbelief, spontaneous utilization of inferences to resolve the inconsistency, and an overriding faith in the belief that speakers and writers usually intend messages to be truthful, relevant and unambiguous, also contribute to infrequent reports of text inconsistencies (Winograd and Johnston, 1980).

In addition to factors related to why subjects may not overtly respond to errors in text, other design problems may be inherent in the error detection paradigm. These consist of (1) lack of specificity in determining the subjects' criteria for comprehension, (2) clearly indicating the location and nature of the target errors, (3) the overreliance on retrospective self reports and (4) the use of this paradigm in isolation of other paradigms (Cavanaugh and Perlmutter, 1982; Winograd and Johnston, 1980).

Although the error detection paradigm is subject to a number of limitations and criticisms, the use of this approach has contributed to our knowledge of the comprehension monitoring process. Essentially, readers do recognize errors in text, however this recognition is dependent upon maturational factors, reading competence and the reader's perception of the criterial task.

In response to text inconsistencies readers reported the use of a number of strategies in an attempt to resolve the potential confusion. These strategies consist of the use of prior knowledge, rereading, and suspending judgement. However, how readers spontaneously use these and other strategies and how these strategies are integrated into a more holistic pattern of remedial action to deal with the comprehension difficulty necessitate further investigation. Furthermore, the extent to which these strategies contribute to both the successful resolution of the comprehension difficulty and criterial task performance also requires more indepth exploration.

Essentially, the error detection paradigm may be useful as a converging measure to deal with questions related to whether readers may monitor their understanding of text. However, for purposes of this investigation more indepth convergent procedures and modes of analysis are required to deal with questions related to how readers monitor their understanding of text.

Retrospective Approaches

Numerous studies have utilized a post-reading interview format in an attempt to assess the nature of readers' metacognitive knowledge with reference to monitoring.

For instance, in the Forrest and Waller (1979, 1980) study reported earlier, the children were interviewed individually and asked 13 standardized questions about decoding, comprehension and advanced strategies. Analysis of performance indicated that knowledge of decoding, comprehension and advanced strategies increased with grade level and reading ability. Of particular interest were the findings that young/poor readers gave little indication they understood how to monitor comprehension. Difficulty was evident in two areas: (1) ability to identify and select task performance clues which could be used as indicators to gauge test performance and (2) remedial action that could be used to correct the situation.

In support, Myers and Paris (1978) found that young poor eight year old readers were less aware of strategies to aid comprehension than their older counterparts. For instance, the older children appeared to know that the purpose for skimming was to pick out informative words. However, the younger children said they skimmed by reading the easy words.

In a subsequent study Paris and Myers (1981), utilizing a similar post reading interview procedure, instructed good and poor fourth grade readers to read and study a story so they could remember the information. Following the recall the subjects were required to report on their reading activities. This consisted of rating the utility of 20 reading strategies on a nine point scale. Analysis of the findings revealed that compared to good readers, poor readers tended to give higher rankings to the strategies which had a detrimental influence on recall.

Similar findings were reported by Gambrell and Heathington (1981) in a study involving good and poor adult readers. In this study the subjects were required to answer questions about the effects of task parameters and cognitive strategies involved in reading. Compared to more proficient readers, the less proficient readers were far less sensitive to strategy variables, the structure of text and their role in facilitating comprehension.

In support, Hare and Pulliam (1980), in an attempt to determine the nature of the relationship between college student metacognitive awareness and reading performance, presented good and poor college students with an informational text. The subjects were required to read the selection for meaning, think about what they were doing while they were reading and upon completion write down everything they noticed about their reading. While all students noted such behaviors as reading for meaning, rereading, selectively reading, adjusting reading speed, becoming distracted, relating reading to personal experiences, reading every word, chunking words, and eyes moving faster than mind, the first four behaviors (reading for meaning, rereading, selectively reading, and adjusting reading speed) differentiated the most between high and low comprehension scorers.

Although research utilizing this particular research mode suggests there may be a relationship between cognitive maturity, reading proficiency and knowledge of factors and strategies related to monitoring of reading performance, this research is fraught with some rather serious shortcomings. For instance, as suggested by Nisbett and Wilson (1977), Nisbett and Bellow (1977) and Cavanaugh and Perlmutter (1982), individuals may have little direct access to higher order cognitive processes. Consequently, what readers say they do when they read and how they actually process print may be very different. Furthermore, as noted by Hare and Pulliam (1980), good readers and certainly more mature readers may be more articulate and verbal than less mature and less proficient readers. This suggests that the apparent limited metacognitive functioning of the less proficient and mature readers may be more a reflection of their verbal ability than their metacognitive functioning. Essentially, the reader's verbalized metacognitive knowledge may not be directly related to their personal metacognitive knowledge.

By way of summary then, verbalization, particulary in response to leading questions, may not be an accurate reflection of the reader's awareness about his/her performance. This is further confounded if the reader is required to reflect and theorize upon past performance as opposed to during reading performance. As noted earlier in the discussion, the primary focus of the existing research has been more on whether or not the reader monitors. However, as it has been pointed out in several instances in the preceding literature review, many other facets of this area are probable and there appears to be an obvious need for a more indepth examination of how readers monitor their understanding of text.

Introspection and Protocol Analysis

Varying degrees of introspection using complete text is another procedure utilized by researchers in an attempt to develop a further understanding of the utilization of monitoring in the comprehension of text.

A study by Olshavsky (1976-77) typifies the use of this paradigm. In an attempt to identify the type of strategies readers employ to comprehend an author's message, Olsahvsky (1976-77) presented tenth grade good and poor readers with narrative passages. The subjects were required to think aloud each time s/he reached the end of an independent clause. This was signalled for them by a red dot. In this way the procedure involved both retrospection and protocol analysis. Analysis of the protocols revealed the use of ten strategies. Olshavsky then clustered these into word, clause and story related strategies. Of primary interest are the monitoring strategies at the word and clause level. At the word level the strategy consisted of a stated failure to understand a word. However, the strategies which followed in an attempt to resolve this difficulty were not discussed. At the clause level Olshavsky (1976-77) found that the majority of the readers utilized two strategies related to the monitoring of understanding. These consisted of a stated failure to understand a clause strategy (recognition of comprehension failure) and a rereading strategy (remediation procedure). Although all the readers used similar strategies, the more proficient readers used more strategies than the less proficient readers. This in itself is revealing and certainly supports the findings of O'Brien (1981). However, what would be of greatest interest here is how the patterns of strategies used by readers differ. In other words, what is crucial here is the examination of the relationship of strategies and how certain patterns of strategies used relate to understanding. In addition, the reader's perception of the criterial task was not explicitly noted in the Olshavsky (1976-77) study. As noted by Smith (1967) the extent to which a reader reads for purposes of different interpretations will have an impact on the strategies utilized to derive understanding of the text. This may have been a crucial factor in the findings of a follow-up study conducted by Olshavsky

(1978). In this study good and poor eleventh grade readers were presented with narrative passages progressively increasing in difficulty. However, contrary to expectations the incidence of strategy usage decreased as the passages became more difficult. It is quite possible that the pursuit of meaning could have been a primary purpose for reading the initial less difficult passages. However, as the passages became more difficult the reading purpose could have changed and consequently the utilization of strategies to facilitate understanding could have been reduced. This would also lend support to the notion that readability is not purely a function of text, but may be more a function of how the individual interacts with the text. This being the case, one could expect readers to select and apply different strategies and patterns of strategies to meet what they viewed as the criterial task, particularly if the criterial tasks were too overwhelming. This suggests that passages used to assess monitoring should be difficult enough to ensure spontaneous monitoring but not so difficult so as to result in frustration and a breakdown of strategy use.

A further study which utilized a procedure of protocol analysis was reported by Christopherson, Schultz and Waern (1981). They presented high school students with contextual (title) and decontextualized (no title) passages. They were required to read the experimental passage out loud and comment on their thoughts. Upon completion they were instructed to write down as much of the passage as they could remember. Statements denoting the degree of the subjects' understanding of the text, such as "I don't understand" differed across conditions. Other attempts consisting of matching text meaning with prior knowledge ("I didn't know that") or with prior text meaning ("That's not what the author said before") also differed across conditions. Although these reader comments and reflections suggest differences in strategic intervention, the possible strategies utilized by the readers to monitor their understanding were not presented. Nevertheless, the critical importance of this study is in the effect different textual conditions may have on subsequent processing.

In a more recent study by Mitchell (1981) the categories in the above research were revised. In this study voracious adult readers of fiction were required to respond to different types of text (fiction, nonfiction). Two types of responses (metastatements and misreading) indicated that the readers were monitoring their understanding of the text. Metastatements included comments that suggested that there was no match between what the reader read and what made sense to him/her, while misreadings indicated the reader had failed to understand the text even though what he read made sense to him. Interestingly, the incidence of monitoring was appreciably higher in the nonfiction than the fiction text. Mitchell (1981) noted that many readers read along automatically and responded with cognitive match statements ("I see"). However, when they encountered difficulty, particularly when reading the nonfiction text, they reverted to restatements and metastatements. At this point processing was described by the subjects as becoming less automatic and more conscious. This supports the notion proposed by Brown (1980) that as the task becomes more difficult readers may, depending upon proficiency and cognitive maturity, more consciously intervene strategically to comprehend the text.

This notion proposed by Brown (1980) may have certain implications for the use of probing in the present study. Since one of the primary concerns in probing and concurrent verbalization is the extent to which this procedure may interfere with unconscious text processing, and since difficulty tends to contribute to more conscious processing, probing and the encouragement of verbalization at this point may not adversely affect text processing and understanding. However, as noted by Olshavsky (1978), if the text is too difficult the incidence of strategic intervention is reduced. This suggests that nonfiction text that is perceived as challenging but yet not overwhelmingly difficult by readers would more likely facilitate conscious strategic activity. This strategic activity, if articulated by the reader through concurrent verbalization, would then be open to scrutiny and analysis by the researcher. As evidenced by the present literature review this has not been thoroughly examined and as such constitutes a major thrust of the present study. However, some preliminary work has been recently reported which was considered a promising lead to the present investigation, and thus warrants a brief discussion here.

In an exploratory study by Collins, Brown and Larkin (1981) four adults were required to listen to five difficult-to-understand

and talk about how they attempted to understand the text. Analysis of the protocols revealed that the subjects attempted through a procedure of progressive refinement to construct a model of the text. Of interest is the consistent reported use of a variety of general-purpose problem solving strategies to construct a model of the text. These will be individually discussed and illustrated through reference to the experimental text used by Collins, Brown and Larkin (1980).

Boating Text

> John and Bill were sailing on Mystic Pond, and they saw a coffee can floating in the distance. Bill said, "Let's go over and pick it up." When they reached it, John picked it up and looking inside said, "Wow, there are rocks in the can." Bill said, "Oh, I guess somebody wanted the can to float there."

1. Rebinding: Changing the last variable bound to the model of the text reconstructed. This usually occurs if the value of variable bound to the text leads to a conflict. In an attempt to resolve the conflict the individual trys another binding for that variable.

> E.g. Well the can was either opened and then somebody closed it using a plastic lid or some other kind of lid, in which case if they didn't open it, then I don't see how they could have gotten the rocks into it, so they must have opened it.

In this instance this individual considers the possibility that the can had never been opened. This of course leads to the conflict with the fact that the can had rocks in it. At this point the subject resumes the assumption the can had been opened.

2. Questioning a Default Interpretation: Questioning initial assumption the individual may have made about the text.

E.g. This is a real world, the rocks are normal and the can is a standard coffee can.

3. Questioning a Direct or Indirect Conflict: This involves the questioning of an earlier binding.

E.g. One subject decided there was a plastic lid on the can. Later while considering the function of the rocks, he considered the possibility that the rocks were lighter than water and their function was to displace water. However, for the water to get into the can there had to be some opening. Either there was no lid on the can or the lid leaked.

4. Near or Distant Shift of Focus: If a subject cannot solve a question he may move to another question closely related to the previous question.

E.g. A change from Why didn't the can sink? to What was the purpose of the rocks?

5. Case Analysis and Most Likely Case Assignment: The systematic consideration of all alternative possibilities and the selection of the most likely possible in an attempt to constrain the possible solutions.

E.g. Initially considering whether the can was open or not, to finally deciding that the can was closed with a plastic lid, and contained only rocks.

The analysis of the protocols also revealed that the subjects evaluated a number of models while trying to make sense of the text. According to Collins, Brown and Larkin (1980), the subjects applied four different tests to assess the plausibility of the models against their world knowledge.

1. The plausibility of the assumptions and consequences of the

model, and how these relate to the subject's world knowledge.

E.g. Assuming that Mystic Pond was salty, by thinking of cases of salt water lakes, but then deciding that it was inplausible that salt water would hold up a can filled with rocks.

2. The completeness of the model in terms of how well the assumptions and consequences of the model answer all the questions that arise.

E.g. Assuming the pond was comprised of salt water would answer the question, Why didn't the can sink? but this would not answer the question, What was the function of the rocks?

3. The interconnectedness of the model in terms of how well all parts of the model fit together.

E.g. In the final evaluation of the model, the winds entered in two ways, to sail the boat and a force to anchor the can against.

4. The match of the assumptions and consequences in terms of particular aspects of the text.

E.g. Sailing on the pond could not mean ice sailing, since the can was floating and was not held up by ice.

Although the above progressive-refinement theory of text understanding and constraint satisfaction as outlined by Collins, Brown and Larkin (1980) may have some limitations particularly with reference to the schema theoretic view of understanding (Thorndyke and Yekovich, 1980), and the readers' use of questions to facilitate the construction of text models, their attempt to outline some of the inferring strategies readers may use to reconstruct text may have some utility for a more refined system of analysis to determine how readers may attempt to overcome comprehension difficulties.

For instance, Phillips-Riggs (1981) tested aspects of this model using narrative text with sixth grade students. In addition to recognizing the strategies of rebinding, questioning a default interpretation and refocusing, a number of other strategies emerged. These are:

1. Analysis of Alternatives. The reader suggests a number of possible alternatives, however a selection is not made until more information is available. This strategy is primarily characterized by tentativeness.

2. An Alternative is Held in Abeyance. An alternative is selected and held in abeyance because the alternative does not fit the prior or subsequent data.

3. Confirming an Immediate Prior Interpretation. A response is devised to maintain consistency with an immediate prior response.

4. Confirming a Non-immediate Prior Interpretation. The reader selects a prior interpretation which was held in abeyance. This selection is based on subsequent information.

5. Transformation of Information Based on a Default Interpretation. The reader alters new information to maintain consistency with a prior interpretation, in spite of inconsistencies. Essentially, the reader bases an assumption on incorrect knowledge.

6. Empathizing from Experience. The reader may project him/herself into the actual situation and experience another condition or state. This is then made part of the interpretation.

7. Neglecting to Respond. In this case the reader does not respond or reiterate a previous interpretation.

The collective strategies outlined by Collins et al. (1980) and especially those outlined by Phillips-Riggs (1981) appear to be primarily dependent upon self questioning or responding to externally posed questions, and as such may restrict explorative possibilities in determining how readers spontaneously monitor their understanding of text.

However, keeping this possible limitation in mind, these categories could serve as a tentative basis in this investigation for the preliminary analysis of the strategic procedures spontaneously initiated by readers in an attempt to resolve particular comprehension difficulties. Furthermore, because of the particularly revealing nature of concurrent verbalization and protocol analysis, this procedure will be adapted and utilized in this study.

The review of the literature has thus far indicated a number of procedures that have been employed to investigate the monitoring process and related reading comprehension processes. Even though these procedures have advanced our understanding of this crucial reading component, it would seem that except for protocol analysis (concurrent verbalization) the remainder of the other approaches in themselves were not suitable for the purposes of the present research problem. There is, however, a well-known procedure that was considered to be highly appropriate for the problem of a more indepth examination of how the monitoring process operates with proficient readers. This procedure, the cloze procedure, has been reported in the literature for nearly thirty years and has recognized validity as a reading comprehension measure.

Cloze Procedure

This technique initially devised by Taylor (1953, cited in Taylor, 1957) requires the reader to fill in deleted portions of passages. Although many formats have been used, the reader is usually presented with a passage in which every nth word is deleted and s/he is required to fill in the appropriate term. The utility of this technique, in conjunction with introspection and protocol analysis, as a way to gain insight into how readers comprehend has been aptly demonstrated by Jenkinson (1957).

Descriptive metaphorical, allegorical and ironical cloze texts were presented to 11 above average and 11 below average high school subjects. The students were required to retrospect in one condition and introspect in the other condition as they completed the passages. Analysis of the protocols revealed that although the groups did not differ in their awareness of errors, the more proficient readers were more likely to retrospect to check meaning, correct errors and assume a tentative stance than the less proficient readers. Of interest was the ability of the more proficient readers to shift approaches to meaning and adjust the interpretation to include the meaning of the whole passage.

Another study, more limited in scope, was conducted by DiVesta, Hayward and Orlando (1979). Two cloze paragraphs, one in which the initial half was left intact and the other in which the final half was left complete, were presented to sixth, seventh, eighth and secondary good and poor readers. Twelve unrelated paragraphs comprised the test which was purported to measure differences in readers' use of running and subsequent text. As expected, the older and more proficient readers performed equally as well in both cloze conditions. However, the less mature and less proficient readers performed more poorly when they were required to make use of subsequent text to complete the passage. These findings suggest that less proficient and less mature readers make less efficient use of the strategy of searching subsequent text for clarification and possible confirmation of a response. Unfortunately no other introspective, retrospective or on task data were gathered by DiVesta et al. (1979) to confirm the interpretation of their findings.

The cloze testing procedure, since its inception, has been considered a reliable, objective measure of comprehension. This is evidenced by psychometric strengths (Jenkinson, 1957; Taylor, 1957; Bormouth, 1969; Entin and Klare, 1979; Lamb, 1979), process measures (Jenkinson, 1957), measures of learning from text (Rothkopf, 1968), measures of literal comprehension (Berk, 1979), measures of ability to employ macrostructure operations (Thomas and Bridge, 1980) and measures of text recall (McGee, 1981).

However, debate still reigns as to what aspects of comprehension are involved and measured by the procedure. One of the major criticisms of the cloze procedure is in regard to the lack of sensitivity of this measure to the influence of context beyond the immediate sentence level. This concern was initially voiced by MacGinitie (1961) and Miller and Coleman (1967) and more recently by Caroll (1972) and Hoffman (1980). According to Shanahan, Kamil and Tobin (1982) this lack of sensitivity was aptly demonstrated in a study in which they presented a different cloze condition to each of three groups of college students. One group received standard passages, a second group received the same passages but with scrambled sentences and a third group received other passages which contained embedded sentences from the original passages. In an attempt to control for a ceiling and floor effect the nonfiction passages were written at three different levels of readability, seventh to eighth grade level, eleventh to twelfth grade level and college graduate level of difficulty. All sentences were of lengths equal to multiples of five, and every fifth word was omitted in the sentence. Shanahan et al. (1982) and Cziko (1983) noted that the texts were not constructed to be especially sensitive to intersentence information usage. No performance difference was found across the three conditions. According to the researchers these findings suggest that the cloze procedure is insensitive to the use of intersentential information, and may not be a good measure of intersentential information integration.

These findings do suggest that cloze performance may be largely influenced by the cues in the immediate context around the missing word. However, other researchers have reported evidence to the contrary.

For instance, Rankin and Thomas (1980), in an attempt to investigate the influence of familiarity upon contextual constraints, assigned eighth grade students to two conditions, pretreatment cloze with no prior reading of the selection, and post-treatment cloze with one prior exposure to the selection. Four deletion ratios, every fifth, sixth, tenth or fifteenth word was omitted from the descriptive narrative texts. The researcher found that individuals who were permitted to read the passage before completing the cloze version of the text performed better, particularly with reference to content words, than individuals assigned to the pretreatment cloze condition. Greater context (lower deletion ratio) facilitated inferences for content words, but this condition appeared to reduce performance in prediction of function words. This finding had already been established by Taylor (1957). Such difficulties in predicting function words and the influence of prior exposure to the text (familiarity) on subjects' cloze performance suggests that the cloze procedure is more than just a measure of responses to local contextual constraints.

Further evidence in this vein was provided by Thomas and Bridge (1980) who found a high correlation (.80) between eighth grade student cloze performance and recall of larger cohesive units.

Similarly, McGee (1981) found that fifth grade less proficient readers could remember more after completion of a cloze passage than if just required to read and recall the information in a noncloze situation. The evidence from these two studies would further suggest that cloze performance is affected by intersentential contextual constraints. If this were not the case, recall performance would be inhibited by a cloze task.

In summary, it would appear that many variables including the nature of the text (familiar vs unfamiliar) and nature of the deletion (random vs select) will affect cloze performance.

For the purposes of the present study the cloze procedure was adapted as one of the procedures to explore how readers monitor their comprehension. The primary strength of this procedure is not its ability to predict post-reading performance and readability but rather as Jenkinson (1957), Rankin (1974) and Jongsma (1980) suggest, this procedure can provide us with a slow motion view of significant aspects of the reading process. It would seem likely that the cloze task, if used as a methodology in reading research, could be further strengthened through the addition of protocol analysis (concurrent verbalization) in a collaborative research context. This was therefore included in the experimental design of the present study.

Summary

The research involving the methodological procedures of predicting performance, oral reading, measures of behavioral correlates, error detection paradigms, retrospection, introspection and protocol analysis and the cloze procedure have contributed to our understanding of the comprehension monitoring process. The review of the literature indicates that readers vary considerably in cognitive and metacognitive knowledge, experience, strategic resources and sensitivity to task demands. This variability is further reflected in how readers use these competencies in monitoring their understanding of text. Essentially, readers use aspects of their competencies to (1) recognize comprehension failure has occurred, (2) decide whether or not to attempt a resolution of the failure, (3) implement appropriate remedial action and (4) decide whether or not the action was successful and the difficulty was resolved. Even though this provides a general framework for investigation it seems apparent that many questions still remain. Essentially, what is the nature of the strategies and patterns of strategies readers use in an attempt to resolve comprehension difficulties, and to what extent does this action relate to (1) the successful resolution of the comprehension failure and (2) criterial task performance? Furthermore what are the types of comprehension failures identified by the participants?

This study will attempt to investigate these questions and others through the use of a research design comprised of two convergent methodological procedures, concurrent verbalization and the cloze procedure. The development of these procedures and the research design will be the focus of the following chapter.

Chapter III

THE DESIGN OF THE STUDY

Introduction

The primary purpose of this investigation was to examine how college readers attempted to resolve comprehension difficulties. In order to explore this and other related research questions, four types of reading conditions were developed: Reading Recall (C1), Reading Recall Concurrent Verbalization (C2), Reading Recall Cloze (C3) and Reading Recall Concurrent Verbalization Cloze (C4). These conditions, the participants, the reading material, the procedure, and the accompanying rationale will be presented in this chapter.

The Participants

The focus of this study was the observation of the undergraduate college reader. This population was selected on the rationale that the reading process and strategies of interest would likely be at a more advanced level of development in comparison to elementary and secondary schools.

Furthermore, it was assumed that college students, because of their developmental maturity, would likely be more conscious of their own cognitive activity, be more verbal and reflective and consequently would be more able to contribute in the concurrent verbalizations.

Participants for this study were selected from three sources. For the first preliminary exploration six after degree students were chosen from a Spring Session language arts class being held at the University of Alberta. A second group of participants for the second preliminary exploration, main study, cloze readability and familiarity and idea unit identification and ranking were chosen from three first year undergraduate classes at Mount Saint Vincent University in Halifax, Nova Scotia. An additional 18 graduate students from Mount Saint Vincent University comprised the third population source. These graduate students were chosen from a Masters level graduate course and were used for comparative purposes in the idea unit determination and ranking of the study.

The six undergraduate students for the first preliminary investigation volunteered after the class was approached, and the nature and purpose of the investigation were outlined by the researcher. Although many students expressed an interest in the study, only six students felt they could commit the three to four hours required.

Following completion of the first preliminary exploration, three first year undergraduate psychology classes at Mount Saint Vincent University were approached by the researcher. These classes, two of which were taught by the researcher, were briefly introduced to the study. The students were informed by the researcher that he was interested in exploring how students attempted to understand written material, that 33 students were required and that the total time commitment for each would be approximately 12 hours. In addition, students were notified that those who volunteered to participate in the study would receive partial course credit of 4 percent which would be added on to their final course grade. It should be noted that students were given other research project participation alternatives conducted by other researchers in the department to obtain the additional course credit.

From a total of approximately 210 students approached, 90 volunteered to participate in the research. Of these 90 students, 23 were chosen for the main study, 4 were chosen for the second preliminary investigation, and 6 were assigned to the cloze readability component of the investigation.

The 33 students were chosen randomly from the initial group of 90 volunteers and assigned to the different components of the study. These undergraduate participants were then interviewed briefly, in person or by phone, by the researcher and informed of the component to which they had been assigned and both the time commitment required and the accompanying course credit were again reviewed. At this point all participants were given the option of not participating and if the student chose not to volunteer, they were thanked for their interest and another individual was substituted in their place.

The remaining 57 undergraduate students who had volunteered but had not been selected for participation, were informed and thanked by the researcher for their interest in the study. This was done during regular class time and the procedure used to select the research participants was also outlined. In addition, students were told that if any openings occurred they would be informed, however in the meantime they should volunteer to participate in other research being conducted in the department at that time.

At a later point in time and in an attempt to develop a more clear description of the main passages used in the study a further 12 students were selected from these remaining 57 volunteers. These students participated in the idea unit identification and ranking aspect of the investigation. The participants were contacted in person or by phone by the investigator, and asked if they were still interested in participating in the study. In addition, the students were informed of the time commitment, three to four hours, and the 2 percent course credit. Of the 12 students contacted all agreed to participate.

In total 51 undergraduate students were involved in the study. Twenty-eight participated in the developmental aspects of the design (6, first preliminary investigation; 4, second preliminary investigation; 6, cloze readability and familiarity; and 12, idea unit identification and ranking) and 23 were involved in the main study. Of the 28 undergraduate participants involved in the development aspect of the design, 6 resided in the Edmonton area and 22 lived in the Halifax area. The 6 students in the first preliminary exploration were after degree students, registered in the Faculty of Education, Edmonton, while the remaining 22 students were all first year undergraduate students, and were either registered in Bachelors of Arts, Science, Commerce, or Secretarial Arts programs at Mount Saint Vincent University. All volunteers were women, monolingual English, and were considered full-time students.

In addition to these 28 undergraduate students, 18 graduate students were selected and included in the developmental component of the research design. These students were selected to partake in idea unit identification and ranking of the experimental passages as a basis for comparison with the undergraduate sample involved in this part of the research project. Participation was voluntary.

In total 46 students were involved in the development of various aspects of the design. For a summary of the number of participants involved, their involvement and contribution, time commitment and course credit see Table 1.

The 23 participants in the main study consisted of 22 first year full-time students and one part-time student. All were either registered in Bachelors of Arts, Science or Commerce programs and as indicated by final course grade performance, all were average or above average students. Two of these 23 participants did not complete all 16 sessions and were deleted from the study. Of the 21 who completed all the sessions, 5 were males and 16 were females. All resided in the regional Halifax area and except for one individual were monolingual English.

In summary of this section, 69 students were included in various aspects of the study. Forty-six participants were included in the development of the research design and the remaining 23 volunteers were included in the main investigation. The nature of contributions made by the initial 46 participants will be dealt with in this chapter while the contributions of the 23 main participants will be discussed in Chapter V.

Table 1

Participants' Assignment to Study, Time Commitment and Course Credit

Participants	Purpose	Aspect of the Research	Time Commitment (hours)	Course Credit
6 Undergraduate Students	Development of texts and procedures	First preliminary investigation	2-4	--
4 Undergraduate students	Development of procedures and texts	Second preliminary investigation	9-13	4%
6 Undergraduate students	Description and development of texts and procedures	Cloze Readability and text familiarity	8-9	4%
12 Undergraduate students	Analysis of texts	Idea unit identification and ranking	3-4	2%
18 Graduate students	Analysis of texts	Idea unit identification and ranking	1-1.5	--
46 Total number of students contributing to the development of the design				
*23 Undergraduate students	Data for research questions	Main study	9-13	4%
59 Total number of participants (development of design + main study)				

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*Two undergraduate students in the main study only completed two hours and one session. These students were dropped from the study and received 1% course credit for their participation.

Reading Material

Rationale

The initial selection of the reading material was based on the following considerations:

1. In an attempt to ensure maximum ecological validity, the texts should more or less match the reading material commonly used by the participants and encountered in the college reading situation. Essentially the material is contextually real in both content and genre. A reader does not just read and recall; the participant pursues this encounter for a purpose. Hopefully if the reader views the content as adding and contributing to the information and knowledge required in a course of studies, the material will appear more relevant to the participant. Furthermore, the participant may then be motivated to understand and remember the content for a purpose other than purely meeting the demands of the criterial task. This pursuit of self gain may ultimately contribute to a more varied and data rich encounter.

2. The passages are long enough to provide a wide range of verbal responses but yet not so lengthy that the reading task becomes tedious and frustrating for the participants. The optimum length for this purpose was approximately 750 words.

3. The difficulty level of the passages is such that the passages are difficult enough to encourage the reader to monitor his/her comprehension and move into the conscious mode, but yet not be so difficult that the text may be potentially incomprehensible and a source of frustration for the reader (Brown, 1980). This will hopefully provide more extensive and data rich verbalizations.

4. Nonfiction material was used. Compared to fiction material, nonfiction text should result in more monitoring. This is supported by Mitchell (1981) who found a greater incidence of statements reflecting monitoring in nonfiction reading situations.

5. Although the reading material was selected by the researcher, it was felt that this did not adversely affect the ecological validity of the study since most expository material read by students at the college level was not self selected. Furthermore, readers of self-selecting material may choose material requiring less cognitive effort, and consequently less monitoring may ensue.

Passage Development

Initially twelve 750 word expository passages were adapted from college level expository materials (see Appendix A). Four passages were taken from reading material normally encountered by first year undergraduate education students, five were selected from second and third year college methods texts and three were adapted from upper level college level material. The following is a list of the initial 12 passages constructed.

First year undergraduate materials:

"Concrete Operations"

(Adapted from Kauchak and Eggen, 1980, pp. 64-66, Mussen, 1973, pp. 34-35)

"Inferences: Going Beyond the Information Given"

(Adapted from Kauchak and Eggen, 1980, pp. 37-43)

"The Quest for Equilibrium"

(Adapted from Kauchak and Eggen, 1980, pp. 53-58)

"The Scientific Process"

(Adapted from Kauchak and Eggen, 1980, pp. 3-15)

Second and third year undergraduate college methods materials:

"Developing Children's Abilities to Write Expository Materials"

(Adapted from Hennings, 1982, pp. 8-17)

"Helping Children Develop Skill in Phonic Analysis"

(Adapted from May and Eliot, 1978, pp. 35-49)

"Teaching Children to Find Part-Whole Relationships in Reading Material"

(Adapted from Kachuck and Marcus, 1976, pp. 158-160)

"Seven Steps to Teaching Beginning Readers to Spell"

(Adapted from Gentry and Henderson, 1978, pp. 632-638; Lundsteen, 1976, pp. 347-349; Johnson, Langford and Quorn, 1981, pp. 584-585)

"Word Recognition"

(Adapted from May and Eliot, 1978, pp. 27-35, 110-127)

Upper Level College Material:

"Language and Reading"

(Adapted from Goodman and Burke, 1980, pp. 10-13)

"The Functions of Language"

(Adapted from Tough, 1977, pp. 45-69)

"The Development of Thinking"

(Adapted from Mussen, 1973, pp. 31-36)

First Preliminary Exploration

Although the primary exploration was to examine passage adequacy, procedural aspects were also considered here. This exploration involved six after-degree university students enrolled in a spring session course at the University of Alberta, Edmonton.

Although these sessions were exploratory and no fixed procedure was followed, attempts were made to provide each participant with two different passages, on in a Reading Concurrent Verbalization Recall (C2) condition and another in a Reading Concurrent Verbalization Cloze Recall (C4) condition. Since these participants were after-degree students, all but one were presented with upper level college material. As a basis of comparison the one exception received the passage "Developing Children's Ability to Write Expository Material" in the C2 condition. The selection of passages was based on the assumption that reading material above an individual's level of college enrollment may facilitate more monitoring responses than if the material was below the participant's level of enrollment. Cursory examination of the results revealed this assumption was partially supported. For instance, the one participant who received the below enrollment level passage found the passage very easy and very few instances of monitoring occurred. Overall, only two passages of the initial 12, The Development of Thought and The Function of Language appeared to be difficult enough to ensure extensive and data rich verbalizations. Procedurally it was found that a lengthier practice passage and observation session were required for both of the concurrent verbalization conditions.

Final Construction of Passages

In response to the findings of the first preliminary investigation, and as a result of the final selection of a group of participants from an introductory psychology course, the second and third year undergraduate college methods materials dealing with specific instructional procedures were no longer considered to be appropriate. However, with some minor editorial changes, the passages, The Quest for Equilibrium and The Scientific Process, were retained as material for the observation and practice sessions in this study. These passages were considered difficult enough to encourage some monitoring and also permit the participant to become familiar with the task. Furthermore, the topics of equilibrium and the scientific process were areas that were covered in the psychology course and as such were considered to be of suitable relevance for the participants. The remaining two passages, Concrete Operations and Inferences: Going Beyond the Information Given were not selected because the topics were given less coverage in the psychology course and may have been considered less relevant by the participants.

Following some minor revisions and editorial changes, two upper level passages, The Function of Language and The Development of Thinking, were selected for inclusion in the main study. Both these passages were considered relevant by the researcher since the topics of language and cognitive development were both primary components of the psychology course. The passage Language and Reading was considered to be less relevant and was not selected as material for the study. Two additional passages, Kinds of Variance and Types of Learning, were developed by the researcher. These texts were adapted from upper level college material and like the other texts utilized in the study were related to topics covered in the psychology course.

The final selection of passages for inclusion in this study were as follows:

Passage 1 "The Function of Language" (P1)
(Adapted from Tough, 1977, pp. 45-69)

Passage 2 "The Development of Thinking" (P2)
(Adapted from Mussen, 1973, pp. 31-36)

Passage 3 "Kinds of Variance" (P3)
(Adapted from Kerlinger, 1973, pp. 73-80)

Passage 4 "Types of Learning" (P4)
(Adapted from Gagne, 1970, pp. 47-64)

Practice Passage 1 "The Scientific Process" (Pr1)
(Adapted from Kauchak and Eggen, 1980, pp. 3-15)

Practice Passage 2 "The Quest for Equilibrium" (Pr2)
(Adapted from Kauchak and Eggen, 1980, pp. 53-58 and Ginsburg and Opper, 1969, pp. 18-19)

All passages were written in a descriptive informational style, which provided an explanation or a description of the particular topic. This style is most notably characterized by terseness, density of detail, and generalizations and illustrations about the topic in question (Furness, 1979; Karlin, 1975). All texts were comprised of a main topic and four related subtopics. Each subtopic was comprised of a definition or explanation and if appropriate an expansion to an illustration. All subtopics were ordered as outlined in the topic (Graesser, 1978; Green, 1980; Just and Carpenter, 1980). These passages are presented in Appendix B.

Readability Procedures: Fry and Cloze

Although the primary criterion for readability was that the passages are suitable for the reading situation, as outlined by the previous rationale, two other convergent measures of readability, the Fry (1980) procedure and the cloze procedure (Bormuth, 1968), were utilized. The Fry readability measures indicate that the readability range of the passages was from beginning college level, grade 13, to mid-college level, grade 14 (see Table 2). This would suggest that all the passages are of roughly equivalent difficulty, and are difficult enough to insure some comprehension monitoring. However, due to the possible influence of motivation, wide divergences in academic qualifications of the college population and subject specificity, on the Fry readability norms, the cloze readability procedure was used as an additional control measure.

For this purpose six participants from the initial sample of volunteers were randomly selected (Owen, 1962) and presented with a booklet containing the six passages. Using the cloze readability procedure outlined by Vacca (1980) and Jongsma (1980) every fifth word was omitted. With reference to subject familiarity, each passage was preceded with an open-ended question in which the participant was required to discuss his/her familiarity with the text.

Included were appropriate instructions, a practice passage and questions related to subject familiarity. The order of passage presentation was randomized and participants were encouraged to complete no more than two passages per session. See Appendix C for copies of the instructions, practice passage and subject familiarity questions.

The results of the students' performance on the cloze task are shown in Table 3 and it would appear that except for practice passage one (Pr1), all the passages are of roughly equivalent difficulty (i.e., mean percentage scores of less than 40%). An examination of the low percentage of exact insertions in the passage would suggest that the level of difficulty was sufficient to facilitate monitoring on

Table 2

Fry Readability Scores

	Passage	Readability Grade Score
P1	The Function of Language	13
P2	The Development of Thinking	13
P3	Kinds of Variance	13
P4	Types of Learning	14
Pr1	The Scientific Process	14
Pr2	The Quest for Equilibrium	13

Table 3

Cloze Procedure Percentage Scores

Participant	Percentage Scores					
	P1	P2	P3	P4	Pr1	Pr2
1	36	38	34	26	26	34
2	28	21	20	21	14	39
3	48	54	50	49	51	54
4	32	29	25	25	20	23
5	44	32	48	33	24	33
6	--	32	35	34	34	26
Mean Percentage Scores	38	34	35	31	28	35

the part of the participants. Furthermore, as indicated in Table 4, 66 percent of the responses indicated some familiarity with the passages while the remaining indicated no familiarity with the texts.

Table 4

Text Familiarity

	P1	P2	P3	P4	Pr1	Pr2	Total Number of Responses
Number of participants who expressed some familiarity	3	4	3	4	4	5	23
Number of participants who expressed no familiarity	2	2	3	2	2	1	12
Total number of responses	5	6	6	6	6	6	35

In conclusion, in utilizing these more formal measures to determine text suitability, it would appear that the passages would be of sufficient difficulty to insure some comprehension monitoring. Furthermore, the assessment of text familiarity suggests that the participants at this level may have access to some of the prior knowledge necessary to comprehend the texts.

Idea Unit Identification and Ranking

In order to determine more explicitly the qualitative nature of the texts in terms of levels and numbers of idea units, and to provide a suitable framework for the analysis of the recall protocols, the procedure as outlined by Johnson (1970) and adapted by Brown and

Smiley (1977) and Piche and Slater (1983) was utilized. The choice of this procedure was based on two assumptions. First, the unit used in the analysis of the recall protocol should represent a meaningful division of information as perceived by the participant and second, the analysis should reflect the qualitative nature of the recall protocols. For instance, cursory examination of the recall protocols indicated that many of the participants were essentially providing summaries and elaborations of the text in their recall. Verbatim recall did not appear to be a primary criterion of comprehension for the participants. This suggests that with the use of possible alternative frameworks for recall analysis such as that proposed by Kintsch (1974), the propositions would be too small to reflect this trend. Consequently t-units and incomplete t-units (Hunt, 1965; Fagan, 1978) were selected. In an attempt to insure that the textual units selected would more or less correspond to the units selected for the recall protocol analysis, a procedure by which the texts were divided into idea units and ranked as to the importance of the idea units was carried out with two subgroups of the student volunteer sample.

Idea Unit Identification: Procedure and Analysis

Due to the inherent difficulty of the passages and the possibility that the comprehensibility of the passages may affect both the size and importance of the idea units selected by the undergraduate students, both graduate and undergraduate subjects were used in the procedure.

During a regular class session the four passages, P1, P2, P3 and

P4 were presented to a group of 18 graduate students. Due to time constraints each individual was only required to segment two of the six passages into idea units. The class was presented with the following instructions adapted from Johnson (1970) and Smiley and Brown (1977):

> Please read the passage and then divide the text into individual idea units by placing a vertical line at the division point.
>
> An idea unit is defined as one which contains a complete thought and/or represents a pausal unit (a place where a reader may pause).

For scoring purposes the validity of an idea unit was accepted when at least six out of the nine graduate students agreed that it was acceptable.

A similar procedure was followed for the undergraduate students. In the segmenting procedure 12 students were selected randomly from the original group of 90 volunteers. Each participant was presented with a booklet containing the written instructions, a practice passage and the four passages in random order (see Appendix D for a copy of the instructions and practice session passage). The instructions for the graduate and undergraduate students were similar, except the undergraduate students were additionally presented with a practice passage. The undergraduate students were seen individually and the instructions and their individual responses on the practice passage were discussed with them.

The total time for the idea unit identification phase of the task ranged from 60-75 minutes per participant. Scoring was determined on the basis of eight of twelve participants agreeing on the validity of an idea unit. For both the graduate and undergraduate participants the criterion for acceptability was somewhat more stringent than that suggested by Johnson (1976) and Smiley and Brown (1977) in that these studies only require 50 percent agreement. (See Table 5 for a summary of the results.)

The reliability of the idea units was determined by using the Arrington Formula:

$$\frac{2 \text{ x agreements}}{2 \text{ x agreements} + \text{disagreements}}$$

However, instead of using individual judges, the group as a whole was used. For example, as indicated by passage one, the two groups, undergraduate and graduate students, agreed on 43 idea units and disagreed on seven units. Total agreement amongst the two groups using the above formula was 91 percent. The same procedure was followed for passages two, three and four. The reliability as determined by the two groups ranged from 96 percent to 90 percent. The least agreement occurred with passage number four, however this could be an artifact of the relatively small number of idea units identified by both groups of participants.

Ranking of Idea Units

Although the reliability of the idea units identified between the two groups was quite high, it was assumed that for purposes of this investigation the units selected by the graduate students would be somewhat more valid than those identified by the undergraduate students. This was predicated on the notion that since these passages were adapted from material appreciably above the undergraduate students range of reading experience, the passages may have been somewhat less

Table 5

Reliability of Total Idea Units Identified by Undergraduate and Graduate Students

Passage	Number of Idea Units Identified by Undergraduate Students	Number of Idea Units Identified by Graduate Students	Agreements	Disagreements	Reliability
1	49	43	43	7	91%
2	58	57	55	5	96%
3	56	54	52	6	96%
4	43	36	36	8	90%

comprehensible and certainly more difficult for the undergraduate students to understand. This difficulty with comprehension may have affected the idea unit selection. Essentially it was assumed that one must be able to comprehend an idea unit to identify it as such.

Initially in the ranking of the idea units graduate students were each presented with the same texts they had previously segmented into idea units. Nine of the students received P1 and P2 and the second group of nine students again received P3 and P4. However the passages were already segmented into idea units. To preserve the wholeness of the texts the segmenting consisted only of slashes at the end of an idea unit, and as such the text was kept intact. The participants were required to rank the idea units as to their importance to the central meaning of the passage. A 4 was to be assigned to the units which most supported the central meaning, 3 moderate support, 2 little support and 1 minimal support to the meaning of the passage. The instructions to the students were presented on an overhead projector to the group as a whole. In addition, a passage selected from a study conducted by Smiley and Brown (1977) partially illustrating the outcome of the procedure was presented and discussed. (See Appendix E for the specific instructions and the example passage used.)

The following criteria were used to determine agreement:

Level 4	Five or more participants must agree that the unit was a 4.
Level 3	Five or more participants ranked the unit as a 3 or Five or more participants ranked the unit as 3 and 4 combined.
Level 2	Five or more participants ranked the unit as a 2. or Five or more participants ranked the unit as a 2 and a 1 combined.

Level 1 Five or more participants ranked the unit as a 1. (See Appendix E for specific examples pertaining to the ranking.)

Using these criteria very few units were ranked as Level 1, consequently Level 1 and Level 2 rankings were combined and were viewed as units providing Little Support to the central meaning of the passage.

A similar but somewhat modified procedure was followed for determining the importance of the idea units by 16 undergraduate students. Each of the participants was seen separately and presented with a booklet containing the written instructions and the four passages. Each passage was segmented into idea units and passages were presented in random order. The idea units were those previously identified by the graduate students and the boundaries of the units were represented in the text by slashes. For each participant the instruction was read by the participant and discussed with the researcher. The written instructions were identical to the ones received by the graduate students. In addition, the example passage presented to the graduate group was also presented and discussed. The participants completed only two passages per session, and each session was approximately an hour in length.

The following criteria were used to determine agreement:

Level 4 Seven or more participants must agree that the unit was a 4.

Level 3 Seven or more participants ranked the unit as a 3 or Seven or more participants ranked the unit as a 3 and 4 combined.

Level 2 Seven or more participants ranked the unit as a 2 or Seven or more participants ranked the unit as a 2 and a 1 combined.

Level 1   Using the criterion of seven or more participants ranking a unit as a 1, no instance of the final designation occurred.

Since no instances of Level 1 rankings occurred, this category was dropped and only three rankings were used: Most support the central meaning (4), Moderate support to the central meaning (3) and Little support to the central meaning (2) and (1). (See Appendix E for specific examples pertaining to the rankings.)

The above description of the ranking procedure, adapted from Johnson (1970) and Brown and Smiley (1977), was modified in that these former researchers required the subject to identify 25 percent of the idea units in each category. Consequently each level of importance was assigned to 25 percent of the idea units. This procedure was considered to be too predetermined for purposes of this study. Essentially, it was felt that the reader may not view 25 percent of the idea units as Level 1, 25 percent as Level 2, and so on. Although the level of agreements appeared similar to those proposed by Johnson (1970) and Brown and Smiley (1977), variability within and between both groups of students participants, particularly in borderline cases, was evident. This contributed to less stringent agreement. However, since these rankings were primarily to be used as incidental measures, the ratings were considered sufficient for purposes of the study. Ratings and levels of idea units are presented in Table 6. As noted previously, idea units ranked as 2 or 1 were collapsed because very few Level 1 idea units were identified by the participants, and the reliability differentiating these two levels was very low. The criterion to determine levels of idea units was assumed to be best represented by

Table 6

Idea Unit Rankings and Reliability: Undergraduate and Graduate Students

Level	Passage 1		Passage 2		Passage 3		Passage 4	
	UGS*	GS	UGS	GS	UGS	GS	UGS	GS
Most Support	6 14%	8 19%	6 11%	10 18%	7 13%	8 15%	4 11%	6 17%
Some Support	26 60%	23 53%	38 67%	35 61%	19 35%	12 22%	20 56%	16 44%
Little Support	11 26%	12 28%	13 23%	12 21%	28 52%	34 63%	12 33%	14 39%
Total Idea Units	43		57		54		36	
Total Agreement UGS, GS	38		44		48		28	
Total Disagreement UGS, GS	5		13		6		8	
Total Reliability UGS, GS	94%		87%		94%		90%	

* UGS = Undergraduate students
GS = Graduate students

graduate student ratings. This was influenced by two factors; first the ratings of both the graduate and undergraduate students were generally similar, suggesting general agreement by the two groups as to which idea units contributed the most, some and little to the central meaning of the passages and second, since the readability level of the passages was likely below that of the graduate students, the texts may have been more comprehensible to the upper level students. This factor of comprehensibility as suggested by Johnson (1970) and Brown and Smiley (1977) may have contributed to the increased validity of the idea unit rankings by the graduate students.

Although the Fry and cloze results indicate that the passages may be generally equivalent, this was less evident here. The number and size of idea units per passage differed appreciably, with passage four containing the least number of idea units (36) and passage two the most (57). Although the number of most support units within each passage differed only slightly, the lower level units differed much more appreciably. This variability was most evident in passage number three. This passage was ranked in the upper range of difficulty using both the Fry and cloze procedures. Furthermore, in the main study some participants expressed some frustration in both the style in which the passage was written and the content. The comments of some of those participants indicated that the notion of variance in statistics was of minimal interest and that the passage was redundant and repetitive. Considering the variability present in this case and in the previous procedure, it was decided to randomize the passages within each condition.

Second Preliminary Investigation

Following the construction of the passages, a second preliminary investigation was conducted using four previously selected participants (see Table 1, p. 68). The purpose of this investigation was to examine both the suitability of the texts and the research procedures. This investigation contributed to three changes in the original conceptualization of the research procedures. First, due to the difficulty of the texts, every seventh as opposed to every fifth word was deleted in the cloze passages. Second, even though a pausing point after each sentence was encouraged, some students found this too disruptive. If this appeared to be the case, participants were encouraged to initiate their own pausing points. However, in all cases if monitoring appeared evident the appropriate probes were used. Finally, the word "study" was omitted from the participant instructions and the probe "tell me what you are doing" was deleted. This was adjusted for the reason that the use of the term "study" in the instruction tended to encourage the participants to assume a certain stance that was not wholly appropriate to the task. Assumably a study stance should be initiated by the participant and not imposed by the instructions. With reference to the probe, "Tell me what you are doing," this tended to encourage a large number of metacomments and introspection as opposed to the desired concurrent verbalization responses. These changes were implemented in the research procedure. The research procedure developed for purposes of this study will be the focus of the following major section.

The Research Procedures

Two general procedures, concurrent verbalization and cloze procedure, were used in this study. These two procedures integrated with a collaborative interview format formed two of the primary reading conditions: Reading Concurrent Verbalization Recall (C2) and Reading Concurrent Verbalization Cloze Recall (C4). Two other conditions, Reading Recall (C1) and Reading Cloze Recall (C3), were developed for comparative purposes. The general procedures (concurrent verbalization and cloze), the collaborative interview, the assessment of understanding and the four conditions C1, C2, C3 and C4 will be the focus of the following sections.

Concurrent Verbalization

The use of concurrent verbalization as a research procedure to investigate the reading process has gained wide acceptability, both traditionally (Jenkinson, 1957; Strang and Rogers, 1965) and more recently (Olshavsky, 1977, 1978; Christopherson, Shultz and Waern, 1981; Mitchel, 1981). The strength of this procedure compared to other procedures is that it provides the most direct access to the processes utilized by the reader. However, the extent to which the verbalizations are reliable depends on both the directness of the verbal reports and the time of verbalization. Time of the verbalization is influenced by whether the responses are concurrent (articulated while the information is being attended to or is still in working memory) or retrospective (the information is articulated after completion of task-directed processing). As discussed by

McCown and Johnson (1981) and Ericsson and Simon (1980), the more immediate and concurrent the verbalization, the greater the reliability of the thought processes reflected by the verbalization.

Directness of the verbal reports can occur on a number of levels: direct articulation, in which the reader thinks aloud, verbal recoding in which the participant paraphrases or provides a summary of the thoughts, and mediated articulation in which the individual theorizes and talks about what he or she was doing. The more retrospective the verbalization, the more likely is the possibility that the reader will be theorizing and talking about what s/he is doing rather than articulating the thoughts, no matter how idiosyncratic these thoughts may be. Consequently, the more mediated and retrospective the verbalization, the higher the possibility that the data may not reflect the processes and strategies the reader utilizes in the reading situation. Additionally, as recognized by Nisbett and Wilson (1977), Nisbett and Bellow (1977) and Cavanaugh and Perlmutter (1982), individuals may have little direct access to higher order cognitive processes, thus what readers say they do when they read and how they actually process print may be very different. Readers are not always aware, and possibly should not be, of their own cognitive functioning (Baker, 1979; Brown, 1980). Consequently, to have them retrospect may contribute to less data rich protocols. As such the procedure of concurrent verbalization was selected for use in this study.

Collaborative Interview

The establishment of a collaborative relationship and the selection of appropriate probes were used to increase reliability and validity of this investigation. A collaborative relationship is a relationship in which the participants feel and understand that they are in a situation in which they will interact in a way or collaborate to meet some common aim. Essentially, the interview is viewed as important and significant to both participants. This necessitates the establishment of trust and empathy. It necessitates the establishment of a relationship in which the participants are free to question, disclose and observe (Gorden, 1980).

The establishment of this collaborative relationship was important, primarily because the nature of the study requires the participants to actively and consciously participate in reading situations when they may experience comprehension difficulties. Subjects may react to these difficulties by becoming fearful of failing and refuse to respond. However, it was the hope that through the establishment of a collaborative relationship the participants would realize that the purpose of the study was not to judge or evaluate their personal competence, but rather to explore how they go about resolving comprehension difficulties. Through the realization of this aim the incidence of nonresponse was reduced to a minimum.

The collaborative role was facilitated by the following:

1. Only volunteers were selected, consequently only willing participants were involved.

2. All individuals received partial course credit for their participation. This insured individuals received additional benefit from participation.

3. Although the researcher was initially a course instructor

in which some of the volunteers were selected, this did not appear to detract from the credibility of the interview situation, since this tended to encourage the development of an area of common grounds (Denzin, 1970). This occurred particularly in reference to how the research was conducted (Denzin, 1970). For instance, part of the course content consisted of an introduction to research methods in the field of psychology. An attempt was made by the researcher to discuss with the participants the procedure used in this study with reference to other research methods used in psychology.

Even though the relationship between the researcher as instructor and students was such that this would not interfere with the collaborative relationship, a number of additional precautions were taken. First, while the researcher was the course instructor and if students were selected from the instructor's sections, these students were only included in the second preliminary investigation and second, only students who were not in the researcher's courses were included in the initial phase of data collection for the main study.

4. All participants were presented with a brief overview of the study, its aims, anticipated procedures, and implications. Furthermore, what participants were required to do, amount of time required and possible benefit in terms of knowledge about their own reading, knowledge about research and possible benefits for instruction were discussed. Participants were assured of confidentiality and anonymity (their names were not to be used in the write up of the study). It is hoped that through this introduction the subjects were able to make an informed decisions as to whether they wished to participate or

not. As was suggested by Shatzman and Strauss (1973), the project was presented as honestly and clearly as possible.

5. Feedback concerning general performance for all interested participants was provided following the data collection component of the study. Although all participants were debriefed following the completion of the sessions, a final hour long session was conducted with each individual. The function of this session was to discuss the extent to which participation in the study may have affected the individual's reading performance, and also to discuss the analysis procedure and any tentative findings which may have emerged. The findings were discussed only in terms of the individual participant and in terms of the general theoretical categories which were emerging. Quantitative recall and cloze data were not discussed unless specifically requested by the individual, and then only in very general terms. This session also served as a partial check of the credibility of the findings. Participants were encouraged to discuss and elaborate the tentative findings that were presented to them.

6. Participants were free to question and also to refuse to respond if they wished.

7. Although some baseline measures were needed, the testing aspect of the interview was minimized. It was suspected that any hint of evaluation may detract from the collaborative relationship. The cloze and recall data were regarded in the interview as only a baseline measure, the purpose of which was to compare the participants' performance across conditions.

8. The elements of tact, socially appropriate behavior and attention were observed at all times. Particularly with reference to the notion of paying attention, an element of openness was maintained. This included a watch on one's own and the reader's social behavior, and what the reader was saying. This was particularly important in determining the extent of probing required.

Probing. Other than to familiarize the reader with the particular verbalization reading situation, the initial observation and practice sessions in the C2 and C4 conditions were also used in an attempt to observe the reader's stance in the task. It was thought to be more appropriate to change the probing to fit the particular orientation the reader may have had to the task than to train the participants to meet the task demands. This would hopefully also reduce the probability of any lasting changes in any future text encounters the reader may have.

Some readers verbalized continuously and very few probes were required. However, other participants found the verbalization task very difficult and spontaneous verbalization was appreciably lower. If probes were required they consisted of the following forms:

Level 1 1. Neutral comment (N). Aha.
2. Request (Rq). What are you thinking? What's going through your mind?
Level 2 3. Paraphrase (Par). "not clear" not clear?
4. Statement (St). I notice you are looking back. Could you tell me what you are thinking about? Could you tell me more about that?

Level 3 5. Question (Q). What do you think about that?
Does that make sense to you?

See Figure 2 for a summary of the relationship between these probes and the reliability of the verbalizations. As noted in Figure 2, level 1 probes, (N) and (Rq), were used to encourage direct articulation as the information was being attended to, level 2 probes, (Par) and (St), were used to facilitate verbal recoding while the information may still have been in working memory, and level 3 probes were used to facilitate mediated articulation either while the information may still have been in working memory or after completion of the task-directed processing. The level 3 form of probing primarily consisted of general questions such as, "How did you know you could remember the information?"

The reliability and dependability of the participant responses were assumed to be determined by both the time and directness of the verbal report. Level 1 probes (neutral comments and requests) were assumed to evoke responses which were the most reliable and dependable, while level 3 probes (direct questions) were assumed to result in less dependable and reliable verbal reports.

Essentially, probes were used in this investigation to assist the participant in verbalizing, particularly after a recognizable indication of comprehension failure, and to help the participant clarify particular comments. The following were considered to be recognizable indicators of comprehension difficulties:

1. Facial expressions such as grimaces and frowns.
2. General physical uneasiness

Directness of Verbal Report

Increasing Reliability and Dependability ←

Time of Verbalization

Increasing Reliability or Dependability ↑

	Level 1 Direct Articulation	Level 2 Verbal Recoding	Level 3 Mediated Articulation
A. Concurrent			
As the information is attended to	(N) (Rg)		
The information is still in working memory		(Par) (St)	(Q)
B. Retrospective			
After completion of the task-directed processing			(Q)

Figure 2

Dimensions of Reliability of Verbalizations
(McCown and Johnson, 1981; Ericsson and Simon, 1980)

3. Long pauses

4. Scanning forward or back to previous information

5. Notations on the text, such as notes in the margin, checks, and underlinings.

6. Rereading the text, or aspects of the text

7. Long pauses on cloze omissions

8. Changing a present or previous cloze insertion.

Cloze Procedure

All four passages (P1, P2, P3, P4) and one practice passage (Pr2) for the main study were also converted to cloze passages. The remaining practice passage (Pr1) was left intact and only used in a verbalization noncloze procedure.

The following procedure was used to convert the intact passages to cloze passages:

1. The first sentence was left intact.

2. The starting point for the first deletion was determined by selecting the first seven words in the second sentence and randomly deleting one of the seven words.

3. From this first deletion every seventh word was omitted.

4. The underlined blanks were all of equal length and were 15 typewritten spaces in length.

5. The final sentence was left intact. (Vacca, 1980)

See Appendix G for the cloze version of the passages.

The cloze procedure in conjunction with concurrent verablization was used for a number of reasons: (1) As discussed in the previous sections, other methodologies, because of inherent limitations, are potentially less rewarding. For example, direct questioning may induce artificial responses primarily because the question may structure thought. (2) This procedure tends to arrest the comprehension process thus one can more directly examine the processing strategies of the reader. (3) To a certain extent one can gain insight into the reader's perception of the criterial task. (4) Due to the novelty of the task, individuals may move into the conscious mode more readily and (5) Comprehension difficulties will be more or less observable. Initially a concern was raised as to the extent to which the procedure violated the notion of ecological validity. It was found, however, that many of the participants were familiar with the procedure because the cloze format was used in their psychology course text study guide (G. A. Kimble, N. Garmezy and E. Zigler, Study Guide for Principles of General Psychology (2d ed), Toronto: John Wiley and Sons, 1980).

Assessment of Understanding

Two sources of data, a primary source, recall protocols, and a secondary source, responses to general application and critical evaluation questions, were used to assess the participant's understanding of the passage.

Reading recalls were used as a primary measure of understanding in all four conditions. It was apparent that this measure, although somewhat artificial, was not totally novel to the participants since many of the tasks required of these junior college students necessitated the reading of descriptive expository text and the subsequent recall of information. For instance, over 90 percent of the questions asked in examinations from the course in which the participants were chosen were of the recall type. The following question was used to initiate the student's recall of the passage:

> Could you please tell me everything you can remember about the passage you have read?

Although the reading recalls were used as the primary measure of understanding, general application and critical evaluation questions were also used in an attempt to assess other aspects of comprehension. After the completion of the recall, a question related to the passage and of the following form was asked. For example, the following question was asked if passage one was used in the condition:

> (P1 question) Discuss the extent to which this passage has contributed to your knowledge about the functions of language?

The questions for the other passages are presented in Appendix H. Following the participant's response to the application question, a critical evaluation of the following type was asked.

> Was there any part of this passage you found particularly controversial?

The critical evaluation question was modified if, in the concurrent verbalization condition, the participant expressed some disagreement with the text. For example:

> I noticed you found the notion of error variance somewhat controversial. Was there any other part that you did not agree with?

Participant's Interpretation of the Reading Situation and Criterial Task

Following the discussion of participant's understanding of the text, general questions related to the individual's view of the reading situation and criterial task were posed. The following questions were used to initiate a discussion of the participant's view of the reading situation.

> What do you think of this task?
> What was this task like for you to do?

Two other questions

> How did you know you could remember the information?

and

> How did you know you could understand the information?

were utilized to initiate a discussion of the participant's view of the criterial task.

The Conditions

These aspects of the procedure were integrated to form four conditions: Reading Recall (C1), Reading Concurrent Verbalization Recall (C2), Reading Cloze Recall (C3) and Reading Concurrent Verbalization Cloze Recall (C4). These conditions will each be explicitly discussed in the following sections.

Reading Recall (C1). The reader was presented with the appropriate passage and given the following instructions:

> Here is a passage. Remember the purpose of this task is for you to understand and remember the information. Do whatever you would like to do to help you understand and remember the information in this passage. Take as much time as you need. When you think you can understand and remember the information in the passage I will ask you to tell me everything you can remember and I will also ask you to discuss the passage with me.

The purpose of this condition was two-fold: (1) to examine the quality of the recall of the participant in a nonverbalization and noncloze condition and (2) to assess the extent to which recall quality may be affected by the cloze and concurrent verbalization procedures.

Reading Concurrent Verbalization Recall (C2). The participant was given a text in which s/he was asked to think aloud at the end of each sentence. As indicated by the idea units selected by both the graduate and undergraduate students and incidental comments by participants in the preliminary investigations, pausing at the end of every sentence proved a more natural point to stop.

This task consisted of two sessions, a preliminary observation session and the main session. During the initial session the participant was presented with a text of approximately equal difficulty and length as the main session. All participants were given the following instructions:

> Here is a passage. Remember the purpose of this task is for you to understand and remember the information. As you are going through the passage I would like you to stop at the end of every sentence and tell me what you are thinking. Do whatever you would like to do to help you understand and remember the information in the passage. Take as much time as you need. When you think you can understand and remember the information in the passage I will ask you to tell me everything you can remember and I will ask you to discuss the passage with me.

If participants found these pausing points too disruptive, they were allowed to stop less frequently. In these cases participants would establish their own pausing points. However, in all cases if there was some indication of comprehension failure, probes were used.

Upon completion of the preliminary session, the main session was conducted. Due to the length of time involved in these sessions, two to two and one half hours, the main session was not introduced on the same day. The session usually followed within two to four days and the same procedure was used. As in the C1 condition both the text recall and general discussion questions followed the completion of the verbalization component.

The primary purpose of this condition was to (1) observe the strategies and patterns of strategies utilized by the participants to remediate comprehension difficulties, (2) examine the nature of the difficulties encountered by the participants and (3) examine the success or failure of the remedial action initiated by the participants to remediate the comprehension difficulty. The purpose of the recall component of this condition was to examine the extent to which the concurrent verbalization procedure may affect the quality of the text recall. Ultimately this condition was used to contribute to the partial triangulation of the data, and as such was used to lend support to the findings.

Reading Cloze Recall (C3). The purpose of this condition was to establish a baseline level of participant cloze and recall performance which could then be compared to the performance in the other three conditions. Due to the inherent difficulty of the passages, the use of technical language, and the primary purpose of the task (understand and remember the information), both synonyms and exact insertions were accepted in the scoring. If this condition preceded the C4 condition, a small practice passage adapted from Sacks and Yourman (1971:80) was used to familiarize the reader with the procedure (see Appendix I).

All participants were given the following instructions:

> Here is a passage. Remember the purpose of the task is for you to understand and remember the information. As you are going through the passage I would like you to fill in the blanks

> with the term that you think makes the most sense within the passage. Only one term is needed per space. Do whatever you would like to do to help you understand and remember the information in the passage. Take as much time as you need. When you think you can understand and remember the information in the passage I will ask you to tell me everything you can remember and I will ask you to discuss the passage with me.

As in the other conditions, comprehension and general discussion questions followed the completion of the recall component.

Reading Concurrent Verbalization Cloze Recall (C4). Similar to the C2 condition, the primary purpose of this task was to collect convergent data with reference to (1) the nature of the difficulties encountered by the participants, (2) the strategies and patterns of remedial action utilized by the participants to remediate comprehension difficulties and (3) the success or failure of the remedial action initiated by the participants. The purpose of the recall component of the condition was to examine the extent to which the concurrent verbalization and cloze procedure may affect the quality of the text recall.

Due to the uniqueness of this procedure, the reader participated in a lengthy preliminary practice and observation session. The purpose of this session was to familiarize the individual with the condition, and also to provide the researcher with insights into the participant's stance, response to probes, and response to the demands of the task.

All participants were given the following instructions:

> Here is a passage. Remember the purpose of this task is for you to understand and remember the information. As you are going through the passage I would like you to fill in the blanks with the term that you think makes the most sense within the passage. At the end of each sentence I would like you to pause

> and tell me what you were thinking when you filled in the spaces within each sentence. Do whatever you would like to do to help you understand and remember the information in this passage. Take as much time as you need. When you think you can understand and remember the information in the passage I will ask you to tell me everything you can remember and I will ask you to discuss the passage with me.

Again the comprehension and general discussion questions followed the completion of the recall component.

As in the C2 condition, some participants found the pausing points too disruptive, and again in these cases they were permitted to establish their own. However, in all cases if there was some indication of comprehension difficulty, probes were used.

Two to three days after the preliminary session the main session was conducted and the same procedure was followed.

Final Debriefing Session

All participants in the second preliminary investigation and main study were given an individual final debriefing session. The purpose of this session was three-fold. First, an attempt was made to discuss with the participant the extent to which study participation may have affected his/her present reading performance. This was accomplished through the posing of a number of informal questions such as: Do you read material any different now than you did before your participation in the study? Although all of the 17 participants who participated in the session stated that they seem to read material in a similar manner, if this would not have been the case, the researcher was prepared to pursue this further.

The second purpose of this session was to discuss with the participants the analysis procedures and any tentative findings which may have emerged. The findings were discussed in terms of the individual participant and in terms of the general theoretical categories which were emerging. A common focus of discussion at this point was the use of note taking and rereading. Quantitative recall and cloze data were not discussed unless specifically requested by the individual and then only in very general terms.

A third purpose this session served was to act as a partial check of the credibility of the findings. Participants were encouraged to discuss and elaborate the tentative findings that were presented to them. As in the other conditions, participants were free to raise questions, critique and voice opinions.

The Reading Situations

In an attempt to control for order effect and text difficulty, conditions (C1, C2, C3 and C4) and passages (P1, P2, P3 and P4) were randomized through the use of a 4 x 4 Orthogonal Latin Square. This resulted in 16 different reading situations (P1C1, P1C2, P1C3, P1C4, P2C1, P2C2, P2C3, P2C4, P3C1, P3C2, P3C3, P3C4, P4C1, P4C2, P4C3 and P4C4) and 16 different orders of presentation (see Table 7). Consequently each participant selected for the main study would encounter each of the passages (P1, P2, P3 and P4), each of the conditions (C1, C2, C3 and C4) and the combination of a particular passage and condition (reading situation) only once. The nature of the passage (cloze or noncloze) would depend on the condition associated with the passage. Consequently all passages used in a C3 and C4 condition were cloze pasages while all texts used in a C1 and C2 condition were noncloze passages. For instance, referring to Table 7, participant 8 would be

Table 7

Order of Reading Situations, Participants, Passages and Conditions

Participant	First RS	Second RS	Third RS	Fourth RS	
1	P1C1	P2C2	P3C3	P4C4	4 x 4 Orthogonal Latin Square for first 16 participants.
2	P1C2	P2C1	P3C4	P4C3	
3	P1C3	P2C4	P3C1	P4C2	
4	P1C4	P2C3	P3C2	P4C1	
5	P2C1	P1C2	P4C3	P3C4	
6	P2C2	P1C1	P4C4	P3C3	
7	P2C3	P1C4	P4C1	P3C2	
8	P2C4	P1C3	P4C2	P3C1	
9	P3C1	P4C2	P1C3	P2C4	
10	P3C2	P4C1	P1C4	P2C3	
11	P3C3	P4C4	P1C1	P2C2	
12	P3C4	P4C3	P1C2	P2C1	
13	P4C1	P3C2	P2C3	P1C4	
14	P4C2	P3C1	P2C4	P1C3	
15	P4C3	P3C4	P2C1	P1C2	
16	P4C4	P3C3	P2C2	P1C1	
17	P1C3	P2C4	P3C1	P4C2	Order of reading situations for the remaining 4 participants was selected randomly from the first 16 participants.
18	P4C4	P3C3	P2C2	P1C1	
19	P3C3	P4C4	P1C1	P2C2	
20	P4C2	P3C1	P2C4	P1C3	
21	P3C3	P4C4	P1C1	P2C2	Replacement for participant 11.
22	P3C1	P4C2	P1C3	P2C4	Replacement for participant 3.
23	P1C3	P2C4	P3C1	P4C2	Replacement for participant 9.

RS = Reading Situation
P = Passages
C = Conditions

N = 21

Source: Fisher and Yates, 1953:72,114.

involved in four different reading situations, P2C4, P1C3, P4C2 and P3C1, and P2 and P1 would be cloze passages. However, for participant 2 the order and nature of the reading situations would be different. This participant would be involved in the following reading situations: P1C2, P2C1, P3C4 and P4C3. In this case because P1 and P2 are part of the C2 and C1 noncloze conditions, these passages would be presented in an intact form. However P3 and P4, because of their association with C4 and C3, would be presented as cloze passages.

Implementation of Procedures and Collection of Data

For the main study 23 individuals were randomly selected from the original population of 90 volunteers. The order and nature of the reading situations for the first 16 participants were selected from the 16 x 16 Latin Square while the nature and order of the reading situations for the additional four participants (17, 18, 19, 20) were selected randomly from the first 16 participants (see Table 7). Although three additional participants were selected (21, 22, 23), the order and nature of reading situations for these participants were not determined randomly. Rather these participants served as replacements for participants 3, 9 and 11, when it became apparent that they might not be able to complete all the sessions. This proved to be the case for participants 3 and 9 and these individuals were replaced by subjects 22 and 23. Participant 11 chose to complete the remaining sessions, however participant 21 had already been assigned to replace participant 11 and had already completed a number of the sessions. This resulted in the specific sequence of reading situation P3C3, P4C4, P1C1 and P2C2 occurring three times and was used for participants 11, 19 and 21.

All participants were individually interviewed in a quiet setting, free from distraction, at Mount Saint Vincent University, Halifax. All interviews except the final debriefing sessions were audio recorded. A brief questionnaire was administered prior to the participation in the study. This consisted of questions related to years of post secondary education, program of studies and student identification number. The purpose of the study and the general nature of the investigation were discussed with the voluneer. The following introduction was used with all participants.

> I am interested in how individuals attempt to understand and remember text. You will be presented with a number of different tasks in which you will be required to understand and remember the information. Some of these tasks we will do together and some you will work at independently. There will be seven sessions and the total time commitment will range from 10 to 12 hours. The time set up to complete the sessions will be arranged at your convenience. Everything you say and do will be held in strict confidence. Your name and identity will not be revealed and associated with anything you say or do in the study. If you have any concerns or questions please feel free to raise them at any time.
>
> As a participant you will develop some insights into how research is conducted, how you attempt to understand and remember information from text, and of course you will receive 4 percent course credit for your participation.

Due to the complex nature of the investigation a more indepth review of the procedures was not presented unless requested by the participant. However, for all participants the purpose of the procedure was discussed following the completion of each session. Since the discussion was partially controlled by the nature of the questions asked by the participant, these interactions varied from one individual to the other. In all cases an attempt was made by the researcher to answer as clearly as possible any question the participant may have had.

Following the introduction and a discussion of any questions raised by the participant, the individual was presented with the first reading situation, second reading situation and so on. After completion of each session a question of the type, "Do you have any questions?" was asked. The purpose of this concluding question was to deal with any anxieties, concerns, etc. the participant may have had following the completion of the task.

As indicated by Table 7, the order and nature of the reading situations presented varied amongst the participants, however all members participated in four reading situations and two initial observation and practice sessions. The initial observation and practice sessions were each part of the C2 and C4 conditions.

To clarify the procedure one example will be used. Referring to participant 3, Table 7, this individual participated in the following reading situations:

P1C3	The cloze version of passage 1. The Function of Language was used in the Reading Cloze Recall Condition (C3).
P2C4	This situation consisted of two sessions. The first session consisted of an observation and practice session and included the Pr1 cloze passage, The Scientific Process, in the Reading Concurrent Verbalization Cloze Recall Condition (C4). The second session included the cloze version of the passage The Development of Thinking (P2) in the Reading

Concurrent Verbalization Cloze Recall condition (C4).

P3C1 Kinds of Variance (P3) was used in the Reading Recall Condition (C1).

P4C2 This situation also consisted of two sessions. The first session consisted of an observation and practice session and included the Pr2 passage, The Quest for Equilibrium, in the Reading Concurrent Verbalization Recall Condition (C2). The second session included the passage Types of Learning (P4) in the Reading Concurrent Verbalization Recall Condition (C2).

Final Debriefing Session

In total this individual and others participated in seven sessions, four main sessions, two observation and practice sessions and one final debriefing session. The main session appropriate to the particular reading situation always followed the observation and practice session. Only one session was held on any one day and scheduling was structured for the participants' convenience. The final debriefing session for this and the other participants was held after the data collection phase of the study was completed.

All sessions except for the final debriefing session were audio recorded. It was felt that even though trust between the researcher and the participant had been established, the participant might wish to make certain comments about the study they would wish not to have recorded.

The data for the main study were collected over a six month period ranging from November 1982 to April 1983. In an attempt to retain both continuity and participant familiarity, the participants were placed in three groups, and the individuals of each group were interviewed over a six to seven week time period. Consequently the first group of six participants were each interviewed during November and December, the second seven were each interviewed during January and part of February, and the third group of eight were each interviewed during the time period ranging from the later part of February to the beginning of April. The debriefing session for the participants was held during the months of April and May.

Sources of Data

For purposes of analysis three sources of data were included: the transcription of the taped interviews, field notes made by the researcher after the interview, and the cloze and recall protocols. The taped interviews included the readers' verbal protocols (C2 and C4 conditions), recall protocols and responses to questions concerning interpretation of the general task and criterial task, and text understanding. To minimize the obtrusiveness of the tape recorder all verbal encounters, except the debriefing sessions, were recorded. Furthermore, all the recordings of the four reading situations from the six participants deemed to be the most insightful were transcribed in full. For the remaining participants all the monitoring components were transcribed in full.

The purpose of the field notes were twofold: first to capture the incidental comments that may arise out of the interview, and second to record incidents of the observable behavior that may signal monitoring. These data were used incidentally to support and embellish the primary observations.

Another source of anecdotal data in this study was the incidental notes, summaries, outlines, etc. that the participants made in their attempt to monitor their comprehension. These were used to provide some insight into the more global procedure the subjects undertook, however the focus of this study was to explore the underlying strategies involved in resolving comprehension obstacles, as opposed to the more global procedure that may be involved in comprehension monitoring. Consequently, this served as supportive data as opposed to the primary date.

Summary

This investigation entailed the development of a research design in which 21 individuals participated in four primary reading situations. These situations were developed through the integration of four reading conditions, C1, C2, C3 and C4, and four passages, P1, P2, P3 and P4. While the focus of this chapter was on the development and implementation of these reading situations and the subsequent development of the relevant data, the focus of the following chapter will provide an overview of how the data were analyzed.

Chapter IV

OVERVIEW OF THE ANALYSIS

Introduction

The primary purpose of the investigation was to examine the strategies and patterns of strategies utilized by the reader to resolve comprehension difficulties. In addition, an attempt was also made to examine the nature of the comprehension failures and the extent to which the strategic intervention contributed to the successful resolution of the comprehension failure, and criterial task performance.

The intent of this chapter is to provide the reader with an overview of the analysis of the data. The general framework for analysis was based on both the theoretical position assumed with reference to the monitoring process and the research questions.

Briefly, comprehension monitoring is a process comprised of four aspects: (1) recognize comprehension failure has occurred, (2) decide whether or not to attempt a resolution of the failure, (3) if warranted, implement appropriate remedial action, and (4) decide whether or not the action was successful and the difficulty was resolved. The examination of the comprehension monitoring process in general with specific reference to the nature of the remedial action initiated by the reader to resolve comprehension difficulties was the focus of the investigation and subsequent analysis. In response to this intent, the following questions were developed.

1. What spontaneous strategies and patterns of strategies are utilized by adult readers to resolve perceived comprehension difficulties?

    1.1 What is the relationship between the nature of strategic application and successful resolution of the comprehension difficulty?

    1.2 What is the relationship between strategic application and recall performance?

2. What is the relationship between recognition and nonrecognition of comprehension difficulty and recall performance?

3. What are the types of comprehension difficulties identified by the participants?

4. How do different reading situations affect strategy utilization?

    4.1 How does concurrent verbalization affect cloze and recall performance.

5. What is the relationship between strategic application and cloze performance?

6. What are the general study procedures spontaneously used by the participants and how might these procedures affect recall performance?

Questions 1, 5 and 6 relate primarily to the third and fourth aspects of the monitoring process and questions 2 and 3 relate primarily to the first and second aspects of the process. Question 4 was designed primarily for methodological purposes.

The research design was established to deal with these questions through collection of both primary and anecdotal data. The primary sources of data consisted of the recall protocols from the C1, C2, C3 and C4 conditions, the responses to the comprehension discussion questions, again from all four conditions, the cloze responses from the C3 and C4 conditions, the verbalizations from the participants in the C2 and C4 conditions, and responses to the questions concerning interpretation of the general and criterial task. The anecdotal data consisted of demographic information, field notes and the participants' incidental notes, summaries, and outlines.

The analysis of the data was conducted in two major phases. During the first phase the data were analyzed to delineate the specific categories related to the nature of the comprehension difficulties, the remedial action, and the resolution of the difficulty. The second phase of the analysis involved the examination of the relationship that may exist between the emergent and relevant categories.

First Phase of the Analysis

Analysis of Recall Protocols

Although six recall protocols, two from the practice sessions and four from the main sessions, were obtained for each of the 21 primary participants, only the recalls from the four primary reading situations were transcribed and analyzed. In total 84 recall protocols, four per participant, were obtained and analyzed.

Cursory examination of these protocols revealed that participants were primarily providing summaries and elaborations of the text.

Verbatim recall did not appear to be a primary criterion of comprehension for the participants. Furthermore, when both graduate and undergraduate students segmented the text into idea units, the idea units tended to correspond to large units, more consistent with terminal units as opposed to clauses or syntactic propositions. Propositions would be too small to reflect the trend, thus t-units and incomplete t-units were selected as the common unit of analysis (Hunt, 1965; Fagan, 1978). A t-unit is comprised of a single main clause and any subordinate clauses that are gramatically related to it. Incomplete t-units consist of terms which do not form a complete independent clause, but are necessary to the flow of the language. Specific examples of these units and how these units were adapted to analyze the recall protocols will be specified in the following chapter.

Of primary concern in this study was not just whether the participants recalled information, but how individuals attempted to process and comprehend the text. As evidenced by previous research (Huey, 1908; Gray, 1954; Jenkinson, 1957) and more recent developments (Patching et al., 1983; Rumelhart, 1984; Frederiksen, 1982; Tierney, 1983) inferring, utilization of prior knowledge, summarizing, synthesizing, evaluating and commenting about one's own cognitive performance are all essential components in this process. Consequently it was imperative that the analysis of the recall comprehension protocol reflect these complexities.

Four categories, text specific, text entailed, text experiential and text erroneous were adopted for purposes of the qualitative description. Briefly, text specific responses are comprised of minimally transformed information from the text, text entailed responses are statements summarizing or synthesizing information, text experiential responses are inferences and elaborations used by the reader to fill in the gaps and text erroneous comments refer to incorrect statements made by the reader about the text. These categories and how they were used in the analysis of the recall protocols will be discussed further in the following chapter.

Analysis of Comprehension Discussion Questions

Cursory examination of the comprehension discussion questions indicated that many of the responses were a reiteration of the comments made in the verbalization and/or the recall, and as such, unless particularly revealing, were only dealt with in summary terms.

Analysis of Cloze Responses

Cloze responses, although not a primary measure of comprehension, were analyzed and used as converging support for the assessment of comprehension. The cloze procedure had been used primarily as part of a procedure in an attempt to arrest the comprehension process. However, if one assumes as Berk (1979) suggests that the cloze procedure does involve a significant aspect of reconstruction, particularly literal comprehension, then these cloze responses may be used as a source of converging evidence to support the findings of the recall protocol analysis. Since the primary purpose of the cloze condition as presented to the participants was to understand and remember the information, both exact insertions and synonyms were considered in the final scoring.

Analysis of the Verbalization Protocols

Both the reading situations involving the concurrent verbalization (C2 and C4) conditions included a lengthy observation and practice session. These two sessions for all participants were audiorecorded and subsequently reviewed by the researcher. Although aspects such as how the participant dealt with the task were noted, these sessions were not transcribed.

The audiorecordings of the primary reading situations were each analyzed and reviewed at least three times. The intent of this extensive complete review of the tapes was three-fold: (1) to allow the most pertinent and revealing categories to emerge, (2) to arrive at a suitable coding scheme and (3) to assess the reliability of the coding schemes.

The first review consisted of a cursory examination of the data. During this review the original 9" reel recordings were dubbed on to cassette tapes and the footage of verbalizations related to the monitoring process were noted. Of particular concern were verbalizations indicating the participant was experiencing comprehension difficulty. All comments which suggested the participant was experiencing difficulty were tentatively recorded by noting the footage of the audiorecording at which the difficulty occurred.

Initially these difficulties were indicated on the audiorecording by a specific comment by the reader and/or by some form of spontaneous remedial action. For example, a specific comment by the reader was indicated by the following:

13, P3C2

Sampling variance. I still don't understand what it means.

Although a spontaneous form of remedial action was evident in both conditions, this was far more evident in the cloze condition. For instance, the participant may come to a blank, leave the space, i.e., not make an interpretation, complete the one or two spaces following and then attempt to reread the idea unit and fill in the space. In the cloze condition the monitoring at times was very much a part of the process and the fix-up strategies were almost applied automatically. This is evident in the following example:

In response to the original text

______________3 the first two years of life _____ ________4
child is making enormous strides. ______________5 birth the
infant exhibits a limited ______________6 of uncoordinated
reflexes.

Participant 8, using P2 in a C4 condition verbalized the following:

S I think these they, they're saying that ah during 3 the first two years of life the 4 child is making cognitive strides and ahm they're explaining, ahm, what the child starts doing the first two years. [Completes space 5 with At and then looks ahead.]

Q Notice you're moving ahead. Can you tell me what you're thinking?

S Ahh, I'm just sorta making sure that I stop at each blank cause when I read over them I just kinda forget them altogether. Okay, I'm just trying to understand what the sentence is trying to come across so I can fill in the blanks. [Returns and fills in Ability 6 for space 6.] It's kinda describing, like it could be it's describing something, a condition that the child's going through, ahm, it sounds like a, the child has to learn the ability.

Compared to the previous example, the following response by the same participant was considered somewhat less automatic, but still very much a part of the task.

> Okay, it says the first 8 quarter the first four months show the start of (something) 9. Oh in the first sentence before they're talking about coordination so during the first four months they're probably beginning to control maybe more coordination 9.

In both instances spaces 6 and 9 were considered to be monitored.

In addition to noting the location of the difficulty in the audiorecording, the source of difficulty was also located in terms of the text. This involved the use of two procedures. In the C2 condition the previously numbered idea units were used and in the C4 condition both the previously numbered idea units and cloze deletions were utilized. For instance, if a participant experienced difficulty with the fifth idea unit in passage one, this could be noted by the number 5. If the participant experienced difficulty with two idea units such as 18 and 19, these could also be specified (18, 19). For example, participant 17 made the following comment in response to idea unit number 12 in passage 4.

> Text, P4:
>
> Consequently to inhibit memory loss in discrimination learning, individual chains connecting each distinctive stimulus with each identifying response must be thoroughly internalized by the individual.
>
> 17, P4C2
>
> Don't understand discrimination.

In this case the difficulty would be located in idea unit number 12 and would be coded as a 12. In addition the location of the error on the audiorecording would also be noted.

In the C4 condition, in addition to locating difficulties in terms of idea units, the sources of difficulty could also be designated by the number of the cloze deletion. For example, while completing the cloze version of passage 2, participant 17 experienced difficulty with the ninth deletion.

17, P2C4

Text

The (first) 8 four months show the start of ____________ 9.

Response

M9 Something to do with the child.

This difficulty was designated as an M9 in passage 2, and the appropriate footage of the audiorecording was noted.

Through the designation of difficulties by location it became more feasible to examine the remedial action associated with a particular difficulty. Readers tended to initiate remedial action in terms of particular difficulties and this remedial action often changed, depending on the nature of the difficulty. Furthermore, some participants were highly tentative in response to particular difficulties. This could involve leaving a particular difficulty, continuing on in the text and returning at a later point. This would suggest that remedial action would be initiated across the text and consequently some remedial action initiated during the latter part of text processing would be directed toward some difficulty that had occurred at a previous point. Ultimately without specifying the location of the difficulty, remedial action could not be associated clearly with the particular difficulty.

In addition to noting the comprehension difficulties, the location of the difficulties and the remedial action initiated, an attempt was also made to note verbalizations related to the participant's view of the task, the text, and any other verbalizations which may relate to the monitoring process.

The second review of the C2 and C4 interviews as conducted for purposes of verifying the original notation pertaining to specified comprehension difficulties, the location of these difficulties and the remedial action associated with the difficulties. In addition, the review was conducted to further familiarize the researcher with the data. During this review all relevant data related to the monitoring process were transcribed and noted. This consisted of all the verbalizations associated with the comprehension failures, the remedial action initiated and other comments related to the monitoring process. In addition, comments related to the participant's view of the task, the text, and comprehension and discussion questions were transcribed.

The C2 and C4 protocols of six participants were transcribed in full. Compared to the other protocols, these were considered to be the most rich. For the remaining 15 participants the verbalizations related to and including the recognition of the comprehension failure, decisions involving the initiation of remedial action, the initiation of remedial action and the confirming of the successful resolution of the failure were transcribed in full. Due to the high incidence of monitoring in the C4 condition, these protocols were usually transcribed completely.

In the second analysis of the verbalizations, an attempt was made to allow both the types of difficulties and the nature of the remedial action to emerge from the data. However, categories identified by previous researchers were also utilized. For instance, with reference to types of difficulties Collins and Smith (1981) propose the following taxonomy of comprehension failure:

1. Failure to understand a word. In this case the word could be a novel word, or the word could be known but doesn't make sense in the context.

2. Failure to understand a sentence. The reader can find no interpretation, can find only vague interpretations, can find several possible interpretations, or the interpretation conflicts with prior knowledge.

3. Failure to understand how one sentence relates to another. For instance, the interpretation of a sentence conflicts with another, the reader can find no connection between the sentences, or several possible connections between the sentences may exist.

4. Failure to understand how the whole text fits together. In this instance the reader experiences difficulty developing an understanding of the whole or part of the text.

These categories of difficulties were used to focus the analysis of the comprehension difficulties, however the researcher also attempted to remain open to other categories which emerged through the analysis. These and other forms of difficulties which emerged through this analysis will be further outlined and discussed in the following chapter.

The examination of the remedial action was also based on previous research. However, the researcher attempted to remain sensitive to new categories or forms of remedial action which emerged throughout the analysis. A number of strategies have been identified by previous researchers, of which aspects were included in the analysis.

Table 8 presents a brief review of the strategies and their sources which were considered to be pertinent to the analysis here. A more indepth discussion of these and other strategies which emerged through the analysis will be presented in the following chapter.

Although the third analysis of verbalization protocols in terms of the final relevant theoretical categories will be specifically discussed in the following chapter, the procedure will be briefly outlined in this section and thus will serve as an introduction. In this analysis both the typed transcripts and corresponding audiotapes were used. Difficulties were noted by both source and type. Associated with each difficulty the remedial action was specified. Remedial action was viewed as any response initiated by the participant in an attempt to remediate a comprehension difficulty.

In addition to examining the strategies utilized to remediate comprehension difficulties, an attempt was also made to examine how the strategies were used in conjunction with each other, or how patterns of strategies were used in an attempt to remediate the difficulty. For example, a participant may experience difficulty understanding a particular concept in the text. In response the participant may reread the previous context, may refer to the following idea unit, make a tentative interpretation and go on, and after receiving further confirmation through the following text, return and confirm the tentative interpretation. The patterns of these strategies differ from the patterns in which the individual may encounter difficulty with a particular concept, reread the present idea unit, and then go on. It was these qualitative differences in strategic action that the analysis attempted to reveal.

Table 8

Remedial Strategies and Sources Considered in the Analysis

Remedial Strategies	Sources
Rereading the previous context or current sentence	Alverman and Ratekin (1982) Garner and Reis (1981) Winograd and Johnston (1980)
Lookbacks	Alessi, Anderson and Geotz (1979)
Looking forward to see if the information will be consistent with or can be predicted by present understanding	DiVesta, Hayward and Orlando (1979) Markman (1981)
Formation of a pending question or a tentative hypothesis	Collins, Brown and Larkin (1981)
Referring to an expert source	Collins and Smith (1981)
Suspend judgement—seek clarification in subsequent sections	Collins and Smith (1980) Winograd and Johnston (1980)
Knowledge based strategies by drawing on prior knowledge to bridge gap in understanding	Baker (1979)
Personal identification	Alvermann and Ratekin (1982)
Questioning an initial assumption (refocussing)	Collins, Brown and Larkin (1980)
Analysis of alternatives	Collins, Brown and Larkin (1980)
Rebinding (recognizing the interpretation conflicts with previous interpretation and the readers change their interpretation)	Collins, Brown and Larkin (1980)
Read carefully/slowly	Alvermann and Ratekin (1982)

Establishment of High and Low Recall Groups

For this and other comparative purposes, the verbalization protocols of 10 participants, five designated as the high recall group and five designated as the low recall group, were examined.

These two groups were determined by the following procedure: First the average number of text specific and text entailed complete and incomplete t-unit responses across all four conditions were tabulated and ranked for all 21 participants. The five participants with the highest number of average text specific and text entailed responses across all four conditions were defined as the high recall group, while the five participants with the lowest number of average text specific and text entailed responses across all four conditions were designated as the low recall group. The high recall group was comprised of participants (Par) 16, 1, 26, 2 and 4 and the low recall group consisted of participants 8, 5, 7, 10 and 21. See Table 9 for a summary of these two groups.

Success or Failure of Remedial Action

In addition to the examination of verbalizations in terms of the types of difficulties and the nature of strategic intervention, the data were also analyzed in terms of the success or failure of the remedial action taken. This success and failure was determined by the nature of the cloze responses, the cognitive match statements, appropriate interpretations and confirmation statements. The specific nature of these and supporting examples will be outlined and presented in the following chapter.

Table 9

Number of Total Complete and Incomplete t-Unit Recall Responses for High and Low Recall Participants

High Recall Participants	Text Specific	Text Entailed	Text Specific + Text Entailed	Low Recall Participants	Text Specific	Text Entailed	Text Specific + Text Entailed
Par 16				Par 8			
P1C1	32	2	34	P3C1	8	1	9
P2C2	27	6	33	P4C2	7	3	10
P3C3	15	4	19	P1C3	9	5	14
P4C4	26	3	29	P2C4	14	4	18
Average Number of Recall Responses			29				13
Par 1				Par 5			
P1C1	17	8	25	P2C1	8	1	9
P2C2	10	3	13	P1C2	5	2	7
P3C3	27	10	37	P4C3	15	1	16
P4C4	30	1	31	P3C4	13	1	14
Average Number of Recall Responses			27				12
Par 20				Par 7			
P3C1	17	4	21	P4C1	9	2	11
P4C2	20	2	22	P3C2	13	0	13
P1C3	16	6	22	P2C3	12	2	14
P2C4	16	9	25	P1C4	6	1	7
Average Number of Recall Responses			23				11
Par 2				Par 10			
P2C1	20	1	21	P4C1	5	1	6
P1C2	8	10	18	P3C2	6	1	8
P4C3	25	4	29	P2C3	6	1	7
P1C4	16	2	18	P1C4	7	3	10
Average Number of Recall Responses			22				8
Par 4				Par 21			
P4C1	22	3	25	P1C1	3	2	5
P3C2	26	5	31	P2C2	2	2	4
P2C3	8	2	10	P3C3	2	0	2
P1C4	6	2	8	P4C4	2	0	2
Average Number of Recall Responses			19				3

Analysis of Anecdotal Data

Anecdotal data consisted of general demographic data, the incidental notes, summaries, and outlines that the participants made in an attempt to monitor their comprehension, as well as the incidental field notes made by the researcher after the interview.

Although demographic data related to the nature and year of the academic program had already been obtained when individuals volunteered to participate in the study, data related to I.D. number and residence were subsequently also obtained. These data were simply tabulated and later used as supplementary data to describe the population.

The incidental notes, summaries, outlines, and underlining were categorized in the general construct macroprocedures. These data were used in response to Question 6 concerning spontaneous use of study procedures and the incidence of use was tabulated. Although not definitive, an attempt was also made to examine briefly the quality of the macroprocedures and how these were utilized by the participants.

Field notes were used to embelish the observations made relative to the participants' use of macroprocedures, the individual's orientation to the task, motivation and the participants' interpretation of the criterial task.

Second Phase of the Analysis

The initial phase of the analysis was conducted to delineate the specific categories related to the nature of the comprehension difficulties, the remedial action and the resolution of the difficulty. A second phase of analysis was initiated to examine the pertinent relationships specified in the following research questions.

1.1 What is the relationship between the nature of strategic application and success resolution of the comprehension difficulty?

1.2 What is the relationship between strategic application and recall performance?

2. What is the relationship between recognition and nonrecognition of comprehension difficulty and recall performance?

4. How do different reading situations affect strategy utilization?

 4.1 How does concurrent verbalization affect cloze and recall performance?

5. What is the relationship between strategic application and cloze performance?

6. What are the general study procedures spontaneously used by the participants and how might these procedures affect recall performance?

The examination of these relationships involved both a general trend analysis involving all 21 participants and an indepth comparative analysis of the five high and five low recall participants (see Table 9).

To examine the extent to which the reading situation involving concurrent verbalization may affect recall performance a one-way analysis of variance was conducted. The scores of all 21 participants were used in this procedure (Nie et al., 1975:422-430). A t test for correlated samples (N = 21), as specified by Ferguson (1976:154) was used to examine the extent to which concurrent verbalization may affect cloze performance. (These procedures relate to Question 4.1.)

Although a parametric procedure was considered appropriate for examining the above relationships, non-parametric procedures were considered more appropriate in examining the remaining relationships. These procedures were adopted because of the ordinal nature of the data (the intervals between the sets of tabulation pertaining to strategic actions were not clear) and the small sample size, particularly with reference to the comparison of more and less successful participants.

Table 10 presents an overview as to the statistical procedures that were used in examining certain relationships in response to the research questions.

The Spearman rank correlation coefficient is a measure of association which requires that both variables be measured at least on an ordinal scale. The variables relating to Questions 1.2 and 2 were all considered to be at least on an ordinal scale and consequently this procedure was considered to be appropriate (Nie et al., 1975:288-292).

The Mann-Whitney U Test was used to assess whether the two groups, most and least successful participants, differed significantly on a number of variables, recall performance, strategic action, cloze performance, and types of errors. (These variables are related to Questions 1.1, 1.2, 2, 5 and 6.) This test was used as an alternative to the parametric t test because the assumptions related to sample size and interval data were not met. A sample size of five per group was considered too small and tabulations primarily with

Table 10

Summary of the Relationships between Research Questions and Statistical Procedures

Research Question	Statistical Procedures Total Group N = 21	 High and Low Recall Group n = 5
1.1		Mann Whitney (U)
1.2	Spearman Rank rs	Mann Whitney (U)
2	Spearman Rank rs	Mann Whitney (U) Wilcoxon Matched Pair Signed Ranks Test (W)
4		Wilcoxon Matched Pair Signed Ranks Test (W)
4.1	One Way Analysis of Variance F	
5	t Test for Correlated Samples	Mann Whitney (U)
6		Mann Whitney (U)

Level of significance for all statistical tests was set at .05 or less.

reference to strategic action were considered to be of an ordinal nature as opposed to interval. The procedure for small samples as outlined in Siegel (1956:120) was used.

The Wilcoxon Matched Pairs Signed Ranks Test was used as a supplementary test for Question 2 and a primary statistical procedure for Question 4. The test was used as an alternative to the parametric t test for correlated samples. Again the nature of the data and the small sample did not warrant the use of the parametric procedure. In this case the procedure as outlined by Ferguson (1976:331) was used.

In the use of the procedures the specific variables involved in the analysis and results will be presented and discussed in the following chapter.

Credibility of the Emergent Categories

The credibility of the emerging categories: types of errors, strategic intervention and the nature of the successful resolution of the comprehension difficulty, was established through a number of provisions.

A number of these procedures were built into the design of the study. An attempt was made to retain an open and collaborative relationship with the participants. This openness may have contributed to the revealing of verbalizations and feeling that under other less collaborative situations may have been less likely. Contextual reality or ecological validity was considered as a factor in the initial design of the study. Consequently in two of the four reading situations complete texts were used. The texts were long enough to establish some form of continuity in thought and organization, and an attempt was made to relate the reading material to course content. Although the observation may not be considered highly persistent, the lengthy interactions with the participants (10-13 hours with each participant) contributed to a wide variety of data. Furthermore, data pertaining to the major questions and emergent categories were collected from a number of sources. The categories pertaining to the recalls, view of the task, macroprocedures and criterial task performance were obtained from four sources (C1, C2, C3 and C4). The categories pertaining to types of errors, nature of the remedial action and nature of the resolutions were verified by information from two sources, the C2 and C4. In addition the relevant literature was scrutinized and examined both for alternative explanations and possible sources of categories. This use of a variety of data sources contributed to at least the partial triangulation of the data. For instance, most categories which emerged were verified from at least two sources. In addition to the use of lengthy observations, collaborative interviews, partial triangulation and ecological validity in the design of the study, two procedures, member checks and peer audits, were used to further establish the credibility of the emergent categories.

Member checks were conducted during the final debriefing session. Each of the 17 participants from the original group of 21 main participants and four participants from the second preliminary investigation was presented with some of the observations particularly pertaining to their individual performance.

During this session the intent of the study was discussed with each participant. In addition, particular observations pertaining to remedial action the participant may have initiated in response to comprehension difficulty were presented. This interaction usually consisted of the following type:

> [Name], when you experienced difficulty I noticed you did a number of things. Sometimes you would reread the previous part of the text, and at times you would look ahead in the text. Are these usually the things you do when you experience difficulty or do you also initiate other actions?

The primary purpose of this type of question was two-fold: first, to examine the extent to which the strategic actions which emerged from the data pertained to the action actually initiated by the participant, and second, to examine the underlying intention of certain actions. For instance, many individuals utilized a form of note taking as a macroprocedure. However, how this procedure was used to resolve comprehension difficulties varied considerably from one participant to the other. For example, the notes of the high recall group tended to be rehearsed, reviewed and at times underlined, while note review and rehearsal were only incidentally utilized by the less successful participants.

In an attempt to allow as much openness as possible, particularly with reference to the participant's view of the categories and interpretation of the study, this session was not audiorecorded. Although no time limit was set for this final sesssion, most participants because of time pressures pertaining to final examinations and other year-end commitments were only able to contribute 30 to 40 minutes of their time. Consequently, only the most frequently used and most representative strategic actions were discussed. Although no formal tabulation of the student responses was noted, general agreement did appear to exist between the observations of the researcher and the participant. Some differences did exist, particularly with reference to the use of macroprocedures, or more general study strategies. A number of individuals suggested that they would have reread and made notes more often if studying at home. Other references were made to the use of more breaks, and learning of the material over a longer period of time.

In addition to the use of member checks to examine the credibility of the categories pertaining to strategic intervention, a number of peer audits were also conducted. Initially, aspects of the audiotapes of two participants were each presented to two members of the advisory committee. The purpose of this interaction was to share interpretations of observations pertinent to the data, with particular reference to the nature of the strategic intervention initiated by the participant.

At a later point the emergent categories, both with reference to strategic action and types of errors, were presented to a group of peers, both within and outside the field of reading. The emerging categories and examples of the protocols related to the categories were presented and discussed. Following this session some of the categories were also presented to another audience. In this instance these consisted of a group of graduate students. As in the previous case examples and strategies were discussed. During all these sessions the researcher was open to comments and insights provided by the different audiences.

A more formal peer audit was conducted using three markers, the investigator and two academics, one in the field of Curriculum and Instruction, Language Arts and the other in the field of Educational Psychology. Both of the volunteers were presented with the definitions and related examples of the types of comprehension difficulties and remedial strategies. In addition, each volunteer was presented with the complete typed transcriptions and audiorecordings of the same participant in both the C2 and C4 conditions. For each of the judges a review of all the categories and related examples was conducted. Since the purpose of this audit was not only to examine the credibility of the emerging categories and the scoring, but also to develop new insights into other emerging categories, particularly with reference to the patterns of remedial action, the audit was conducted with the researcher present. The audit was conducted over two 90 minute sessions per volunteer. Only one condition was discussed per session, however because of the indepth analysis of the data, the complete protocol of the participant was not analyzed in total. For each of these sessions only what could be analyzed during the 90 minute session was completed. The auditors' responses with reference to types of errors and strategy action and suggestions and comments were noted by the researcher.

Agreements and disagreements for both the nature of the comprehension difficulties and the strategies utilized in an attempt to remediate the comprehension difficulties across both conditions, C2 and C4, were combined. The Arrington Formula was used and coefficients of agreement were calculated (Feifel and Lorge, 1950:57):

Auditors	Agreement
1,2	94%
1,3	92%
2,3	89%

The assessment of the above results would suggest that the criteria for examining both the nature of the errors and strategy utilization can be applied with reasonable uniformity.

In summary, this chapter has presented an overview of the analysis of the data. The findings, both in terms of the emergent categories and the relationship of these emergent categories, will be presented in the following chapter.

Chapter V

ANALYSIS AND RESULTS OF THE STUDY

Introduction

The monitoring process is comprised of four interrelated components: (1) recognizing a difficulty had occurred, (2) deciding whether or not to initiate some form of remedial action, (3) given a positive decision for step two, then the initiation of further action and (4) deciding whether or not the action was successful, and the difficulty was resolved. In an attempt to reveal the more general nature of this process, data related to all these aspects will be discussed. However, since the primary purpose of this investigation was to examine the strategies and patterns of strategies utilized to resolve comprehension difficulties, this aspect will be given special emphasis.

The concurrent verbalization protocols of six participants were transcribed in full. These were considered by the researcher to be the most data rich. The recall protocols and comments relating to monitoring were completely transcribed for the remaining participants. Due to the difficulty of the C4 condition and the high number of monitoring responses, these protocols were usually transcribed in total. Monitoring comments were based on the third audio analysis. All audio recordings of the concurrent verbalization conditions were coded three times, twice without the transcription and once with the typed copy. The intent of this extensive complete review of the tapes was three-fold: (1) to allow the most pertinent and revealing categories to emerge, (2) to arrive at a suitable coding scheme, and (3) to assess the reliability of the coding scheme. This review also served to provide a more indepth analysis of the participant's reaction to the task and a valuable bank of incidental comments that appear to be particularly revealing and representative of the emerging categories. Once the transcriptions were completed, the final coding of the specific strategies used, monitoring responses and errors detected were completed, using both the audiorecording and the typewritten protocol. The recall protocols of all four conditions were transcribed in full.

General, specific group, and individual trends will be presented. The five highest recall participants and the five lowest recall participants as measured by recall performance will be compared and contrasted. In addition to analyzing the data for purposes of describing the monitoring process, statistical procedures consisting of One-way Analysis of Variance (F), Mann-Whitney Comparisons (U), Spearman Rank Correlation Coefficients (rs) and Wilcoxon Matched Pairs Signed-Ranks Tests (W) were used to reveal trends and the relationships between the emergent categories. The outcomes of both the descriptive and statistical procedures will be presented and discussed in this chapter.

It should be finally noted that although the research questions are answered indirectly in this chapter, these questions will be specifically addressed in the concluding chapter.

Recall: Framework for Analysis

As noted previously, initial examination of the recall protocols revealed that many of the participants were providing summaries and elaborations of the text. Verbatim recall did not appear to be a primary criterion of comprehension for the participants. Furthermore, when both graduate and undergraduate students segmented the texts into idea units, the units tended to correspond to larger units, more consistent with terminal units as opposed to clauses or syntactic propositions. Consequently, t-units and incomplete t-units were selected as the common unit of analysis (Hunt, 1965; Fagan, 1978). As noted in the previous chapter, a t-unit is comprised of a single main clause and any subordinate clauses that are grammatically related to it. Incomplete t-units consist of terms which do not form a complete independent clause, but are necessary to the flow of the language. Irrelevant data, such as audible noise, interjection, and repetitions were classified as mazes and were not included in the formal analysis.

In the following example these units may be distinguished:

> OK, // a man named Piaget believed that there were these stages to child development. A child developing his mind // and there was sensory motor, preoperations, concrete operations and formal operations // And every child went through these when they're developing // (a stage)

T-units //
Incomplete t-unit ________
Maze ( )

The qualitative description included six categories. The initial four, text specific, text entailed, text experiential and text erroneous, were based on the categories outlined by Drum (1978) and

Fagan (1981). The remaining two, critical comments and meta statements, emerged through the data analysis. The inclusion of these two categories was based on the rationale that critical and meta comments constitute a valid response to text, and may in themselves provide a more thorough analysis of how participants attempted to recall the text. In total these six categories are the major focus of the recall protocol analysis, and thus an indepth description of each follows.

A. Text specific responses are comprised of information from the original text which has only been minimally transformed and has a specific reference to the passage. In this case the reader may have reordered or substituted certain terms.

In addition the level of importance of each unit was noted. As outlined in Chapter 3, ranking procedure was carried out by a separate group of graduate and undergraduate students and consisted of high, intermediate and low support to the central idea of the text. For example:

Text:	Two uses of language serve the interpretive function: reporting and reasoning.
Protocol:	There's the interpretive function which is reasoning and reporting.

In addition to this being a text specific response, this idea unit was also categorized as a high level t-unit response.

B. Text entailed responses are statements summarizing or synthesizing information from more than one part of the text. For example:

Text:	The other directive function is evident when language is used for directing the actions of others. This is usually accomplished through demonstrating and instructing.

Protocol: The other directive it's how they speak to other people when instructing or trying to get them to do something.

C. Text experiential responses are statements made by the reader to fill in the gaps in the text, through inference or elaboration. Some examples of these are:

Text: As an example, we may consider how a child learns the concept middle.

Protocol: The concept middle, which is an abstract concept, you've learned it through the help of another concept.

Text: The means of four random samples drawn from a population will differ.

Protocol: So the sample taken in Newfoundland will differ from the sample taken in Ontario.

D. Text erroneous responses are incorrect statements made by the reader about the text. These include incorrect proper names, erroneous expansions or additions and incorrect synthesis, summaries and inference. For example:

Text: How variable is the intelligence of the citizens of Canada?

Protocol: Well they used the example about how high is the intelligence of people in Canada (right) in the first little bit.

E. Text critical responses are statements indicating some disagreement on the part of the reader with the text. For example:

Text: With this dictionary there are obviously no random or chance occurrences.

Protocol: That is a pretty strange point of view.

Text: Relational Function
The purpose of this aspect is language is to establish, maintain and convey relationships between people.

Protocol: This category should be projective, I think because they talked about how a person speaks to relates to another person.

F. Meta statements are responses reflecting the reader's meta cognitive knowledge, experiences, strategies and goals.

Knowledge refers to one's personal knowledge about knowing. For example:

> I thought it was rather complicated.
> That was a bad passage.
> The last stage was in the latter part.
> Then what was their little example with that one?
> My vocabulary isn't adequate to the level that is being expected.

Experience refers to some evaluative statement about the reader's personal progress.

> I'm not sure.
> I know there's more.
> I couldn't connect it.
> I can't remember.
> I don't know if I can remember.
> I thought at the beginning of the article was very confusing. It threw you with the idea of the chair right away, I think because of that the article was a lot harder to think about than the other ones I had come in contact with.

Knowledge about strategic action refers to the reader's knowledge of available strategies and how these can be applied to the comprehension of textual material. For example:

> I didn't make up a code to go with those this time.
> I found it easier with the notes.
> I'm trying to picture it.

Knowledge about the goal or criterial task refers to the reader's understanding of what is required to carry out the task. For example:

> Everything I can remember.
> Do you want me to explain that to you?
> That's all I can remember from that stage.
> Let's see if I can remember them.

As discussed previously, each individual participated in four primary reading situations. Excluding the recall protocols from the training and observation session, this yielded four recall protocols per participant. In the analysis of these recall data, initially, all the mazes were noted. Then all the complete and incomplete t-units were noted. Following this segmenting component of the analysis, each of the t-units and incomplete t-units was assigned to one of the six categories.

Both the segmenting and qualitative analysis were checked using two procedures. First the procedure used and a number of example protocols were discussed with two colleagues who were well versed in the use of this procedure. Secondly a number of personal rechecks of the protocols were conducted by the researcher. In this case the researcher chose a number of protocols and reanalyzed them. Using both these procedures the consistency appeared very high, and since four of these categories had been extensively validated in previous research, the need for further validation and examination of consistency was not considered necessary by the researcher.

Following the coding, the total number of t-units and incomplete t-units were compiled. The instance of each unit's occurrence was assigned a score of one and these were then tabulated for each of the six categories. Consequently each participant received a complete and incomplete t-unit score for each of the six categories. However, due to the fact that there were so few incomplete t-units, these were combined with the complete t-units to form a total score. In addition, each participant also received a score for the level of importance of the text specific responses, thus the total text specific scores was the sum total of high, intermediate and low level text specific, complete and incomplete t-units.

Recall: General Results and Discussion

One-way analysis of variance was used to examine the extent to which the reading situations or conditions may have affected recall comprehension performance. Six areas were of interest in this analysis: Text Specific x Condition, Text Entailed x Conditions, Text Specific + Entailed x Conditions, Text Experiential x Conditions, Text Erroneous x Conditions, and Meta Comments x Conditions. See Table 11 for a summary of F ratios and corresponding probability levels. It would appear that, except for the experiential responses, recall was not significantly affected by the reading conditions. Condition means for text experiential responses are presented in Table 12. Using the Scheffe procedure, shortest significant range of 5.2519, p = .050, only C3 and C2 differed significantly. Essentially participants in the C2 condition tended to elaborate and utilize significantly more background knowledge than in the independent C3 cloze condition. This may suggest an appreciably high preoccupation with the text in the C3 condition and a correspondingly lower use of prior knowledge and personal experiences to elaborate the text. This was, however, not the case in the C2 condition. In this reading situation participants, possibly due to the verbalization context, felt they were required to discuss the text, and consequently utilized more background information.

Table 11

Recall x Condition: Summary of Results

	F Ratio	F Probability
Text Specific x Conditions	1.230	p = .3042
Text Entailed x Conditions	.099	p = .9605
Text Entailed + Text Specific x Conditions	.888	p = .4511
Text Experiential x Conditions	2.939	p = .0381*
Text Erroneous x Conditions	.795	p = .5001
Text Critical x Conditions	.613	p = .6083
Meta Statements x Conditions	.846	p = .4726

Table 12

Summary of Mean Text Experiential Responses x Conditions

Conditions	C1	C2	C3	C4
Means	6.1905	11.0952	4.5714	6.9524

Of general interest in these findings was the almost total lack of word for word recall. Very few text exact or verbatim recalls were evident. Although not of great frequency, some participants chose to respond critically to the text. These observations plus the high incidence of transformations, relations, prior knowledge and retention of the text structure suggest that these participants tended to, as Branford (1979) suggests, construct as opposed to reconstruct the information. Essentially a more global view of comprehension as opposed to a more text specific vies of comprehension was evident.

The findings also suggest that the cloze and concurrent verbalization procedures did not appreciably affect and interfere with recall performance. If this would have been the case one could have expected the C1 recall performances to be appreciably higher than performances in the C2, C3 and C4 conditions. Furthermore, as suggested by Brown (1980) and Mitchell (1981), readers tend to process the text automatically, until they began to experience difficulty. At this point processing becomes less automatic and the readers begin to consciously intervene strategically to comprehend the text.

Related to this is the issue raised by McCowan and Johnson (1981) and Ericsson and Simon (1980). They suggest that the greater the retrospection and mediated articulation the lower will be the reliability and dependability of the verbalizations. Conversely, the greater the concurrent verbalizations and direct articulation the higher the reliability and dependability of the verbalization. In the present investigation if the conditions would have appreciably interfered with processing, the reliability and dependability of the reports would have been reduced. This reduced reliability and dependability would have adversely affected recall performance in the C2 and C4 conditions, which it did not.

Although not reflected by the recall performance, some participants did feel that the verbalization and close condition (C2 and C4) affected their ability to comprehend the information. This may relate to specific situations such as when comprehension was progressing smoothly and the verbalization or request for verbalization serves as an interruption. Interestingly, some participants chose to verbalize continuously. Unless these participants were experiencing constant difficulty, some of the verbalizations would have interfered with the possible automatic processing of the text. In the verbalization condition all but three participants chose to go through the text more than once because they felt that they did not understand and remember the information well enough after the first reading to partake in the criterial task. Some of these participants expressed their feeling that the concurrent verbalization conditions were more difficult in that these tended to break up and segment the passage.

Assessing both the statistical and informal results it would appear that if concurrent verbalization occurs simultaneously with monitoring, recall performance did not tend to be adversely affected.

As a final note, it has already been suggested that this procedure be used to facilitate the comprehension of text (Davey, 1983). Since the present results do not support this notion, the classroom application of this procedure should be used with caution.

Recall: Comparisons of High and Low Recall Participants

One of the primary concerns of this study is the relationship between the quality of monitoring and how this may relate to recall comprehension performance. It was felt that one of the best ways to consider this question was to do an indepth examination of the performance of the five highest and five lowest recall participants in this study (see Table 9, p. 127 and Tables 13 and 14).

As discussed in the previous chapter, the five participants with the highest average number of text specific plus text entailed recall responses across all four conditions (C1, C2, C3, C4) were assigned to the high recall group, while the five participants with the lowest average number of text specific plus text entailed recall responses across all four conditions were assigned to the low recall group. The remainder of this section will describe in greater detail the recall and cloze performances of these two groups.

Comparing the high and low recall participants, some significant differences in all recall categories, except Text Erroneous, were evident (see Table 15). The high recall participants were able to recall more text specific items, summarize and synthesize more information from the text, and were more able than their less successful counterparts to elaborate and relate the text. The groups did not differ in their total text erroneous responses.

Table 13

Recall and Cloze Response Scores: High Recall Participants

	Total Text Specific Responses	High	Intermediate	Low	Total Text Entailed Responses	Total Text Specific + Entailed Responses	Total Text Experiential Responses	Total Text Erroneous Responses	Total Text Critical Responses	Total Metastatements	Cloze % Score
Par 16											
P1C1	32	7	16	9	2	34	5	0	0	3	
P2C2	27	6	17	4	6	33	7	3	0	20	
P3C3	15	5	3	7	4	19	0	1	1	19	85
P4C4	26	13	4	9	3	29	4	12	1	52	82
Par 1											
P1C1	17	6	6	5	8	25	12	1	0	3	
P2C2	10	5	5	0	3	13	20	3	0	3	
P3C3	27	5	9	13	10	37	14	7	0	10	81
P4C4	30	8	11	11	1	31	19	3	0	3	71
Par 20											
P3C1	17	9	3	5	4	21	11	4	0	4	
P4C2	20	8	6	6	2	22	39	1	1	24	
P1C3	16	8	6	2	6	22	3	0	0	9	61
P2C4	16	6	7	3	9	25	17	0	0	4	82
Par 2											
P2C1	20	6	11	3	1	21	7	2	0	1	
P1C2	8	1	5	2	10	18	8	2	0	13	
P4C3	25	7	9	9	4	29	6	0	0	2	80
P3C4	16	4	6	6	2	18	9	5	0	3	83
Par 4											
P4C1	22	6	5	11	3	25	14	0	0	1	
P3C2	26	9	5	12	5	31	19	4	0	2	
P2C3	8	3	4	1	2	10	15	7	0	10	76
P1C4	6	3	1	2	2	8	3	5	0	11	74

Table 14

Recall and Cloze Response Scores: Low Recall Participants

	Total Text Specific Responses	High	Intermediate	Low	Total Text Entailed Responses	Total Text Specific + Entailed Responses	Total Text Experiential Responses	Total Text Erroneous Responses	Total Text Critical Responses	Total Metastatements	Cloze % Score
Par 8											
P3C1	8	3	1	4	1	9	4	4	0	2	
P4C2	7	2	5	0	3	10	7	5	0	6	
P1C3	9	2	5	2	5	14	2	3	0	5	59
P2C4	14	4	5	5	4	18	11	5	0	3	56
Par 5											
P2C1	8	5	2	1	1	9	3	5	0	4	
P1C2	5	1	3	1	2	7	1	3	0	4	
P4C3	15	1	3	11	1	16	0	1	0	6	69
P3C4	13	6	2	5	1	14	2	9	0	2	63
Par 7											
P4C1	9	2	3	4	2	11	5	2	0	6	
P3C2	13	7	2	4	0	13	19	3	2	7	
P2C3	12	5	4	3	2	14	0	15	2	3	65
P1C4	6	3	2	1	1	7	11	1	0	11	71
Par 10											
P4C1	5	3	1	1	1	6	5	0	0	1	
P3C2	6	3	2	1	2	8	1	2	0	2	
P2C3	6	2	4	0	1	7	2	1	1	1	75
P1C4	7	4	2	1	3	10	1	0	0	7	65
Par 21											
P1C1	3	2	1	0	2	5	1	0	0	2	
P2C2	2	2	0	0	2	4	2	1	0	3	
P3C3	2	1	0	1	0	2	1	3	0	2	63
P4C4	2	2	0	0	0	2	0	2	0	1	55

Table 15

Recall and Cloze Performance: Mann-Whitney U Test Score
High and Low Recall Participants

	C1	C2	C3	C4
Text Specific	0**	2.0*	3.5*	3.5*
Text Entailed	4.5	3.0*	2.5*	8.5
Total Text Specific Text Entailed	0**	.5**	3.0	3.5*
Text Experiential	1.0	3.0*	4.0*	6.0
Text Erroneous	15.0	12.0	9.0	9.5
Meta	10.5	8.0	3.5*	4.5
Cloze Performance			4.0*	.5**

* $p \leqslant .05 > .01$
** $p \leqslant .01$

The data reveal that even though the general recall performance of the low recall group was substantially lower than the performance of the high recall participants, relative to the high recall group, a greater proportion of this recall, for the low recall participants, was classified as text erroneous. Although the two groups did not differ appreciably in terms of meta statements in the C1 and C2 conditions, these differences were far more apparent in the C3 and C4 conditions (C4, $U = 4.5$ $p > .05 < .075$). This would suggest that the high recall group recognized the uniqueness of the reading condition and were possibly more willing to reflect and verbalize their experience, knowledge, strategies and perception of the goal. This may have become part of the understanding of the text and consequently was also recalled.

Furthermore, the high recall participants were also able to recall appreciably more of the higher, intermediate and low level idea units. Associated with this superior performance was also the significantly higher cloze scores (see Table 15). Consequently in the cloze conditions there appeared to be a relationship between cloze and recall performance. For the total group ($N = 21$) this relationship was supported by the significant Spearman rank correlation in the C3 condition, Text Specific + Entailed with Cloze Score $rs = .4534$ $p = .019$, and the C4 condition, Text Specific + Entailed with Cloze Score $rs = .3950$ $p = .038$. In support of Thomas and Bridge (1980), the present findings suggest that cloze performance is affected by intersentential contextual constraints. If this were not the case, recall performance would have been inhibited by the cloze task.

Comprehension Discussion Questions: Analysis and Results

Responses to the comprehension discussion questions proved to be a reiteration of the comments made in the verbalization and/or the recalls and as such, unless particularly revealing, were only dealt with in summary terms. These responses were viewed as incidental and were not included in the primary analysis of the data. Furthermore, considering both the nature of the recalls, the inclusion of critical comments in the recall or the verbalization, and the lengthy sessions, particularly the C2 and C4 conditions, it was considered inappropriate to attempt a lengthy discussion through the use of those questions. Furthermore, since many participants discussed their impressions of the text while completing the verbalizations and/or discussing their general view of the task, these questions could possibly have been viewed as redundant by the subjects. As indicated by the responses to the application question, most participants, including the high and low recall groups, felt the passages had contributed to their knowledge (see Table 16). However, examining these results and recall performance, the extent of the contribution and possible expectations of contributions differed considerably between these two groups. The extent to which participants found the texts controversial did not appear to differ appreciably between the two groups. Even though the low recall participants assessed the textual information to be pertinent to the task performance, the recall results suggest that this did not appear to be the case.

Table 16

Comprehension Discussion Questions: Results

High Recall Group	Contribute	Controversial	Low Recall Group	Contribute	Controversial
Par 16			Par 8		
P1C1	1	1	P3C1	1	0
P2C2	1	1	P4C2	0	1
P3C3	1	1	P1C3	1	1
P4C4	1	1	P2C4	1	1
Par 1			Par 5		
P1C1	1	0	P2C1	1	0
P2C2	1	1	P1C2	1	0
P3C3	1	0	P4C3	1	0
P4C4	1	1	P3C4	1	0
Par 20			Par 7		
P3C1	1	0	P4C1	1	1
P4C2	1	1	P3C2	1	1
P1C3	0	0	P2C3	0	1
P2C4	1	0	P1C4	1	1
Par 2			Par 10		
P2C1	1	0	P4C1	1	0
P1C2	1	0	P3C2	1	1
P4C3	1	0	P2C3	1	1
P3C4	1	0	P1C4	0	0
Par 4			Par 21		
P4C1	1	1	P1C1	1	0
P3C2	1	0	P2C2	1	0
P2C3	1	0	P3C3	1	1
P1C4	1	0	P4C4	0	0

1 = Contribute some/aspects are controversial
0 = No contribution/is not controversial

Comprehension Monitoring

The primary purpose of this study was to examine how individuals monitor their comprehension. Monitoring is defined here as a process involving cognitive and metacognitive experience, knowledge, goals and strategies. These aspects are to a greater or lesser degree utilized by the reader to (1) recognize comprehension failure has occurred, (2) decide whether or not to attempt a resolution of the failure, (3) if warranted implement appropriate remedial action and (4) deciding whether or not the action was successful and the difficulty was resolved. The following discussion will provide an indepth description and analysis of these four aspects of comprehension monitoring.

Recognizing Comprehension Failure has Occurred

Framework for Analysis

Difficulty with the text and subsequent difficulty of understanding or meeting the perceived criterial task was determined by both verbal and nonverbal behaviors. Nonverbal indicators consisted of head shaking, facial contortions, quizzical looks, rapid scanning of the pages, lookbacks, or looking ahead beyond the reading point, and with particular reference to the cloze condition long pauses and changes. Verbal statements consisted of verbalized concerns (oh boy, phew, grunts, verbalized hesitations, hmm, umm, let's see) state-of-affairs verbalization (don't know, can't understand, quizzical responses, uh? population variance?) or the questioning of a previous interpretation.

Examples:

20, P4C2

There's something not quite right about my definition of discrimination learning.

8, P2C4

I don't like that.

20, P2C4

I gota get rid of things here.

19, P4C4 (Participant changes a previous cloze insertion)

Task to response. Response is better. They're talking about responding.

These responses were indicators of comprehension difficulty and served as a signal for the experimenter to probe and encourage verbalization. These verbalizations tended to reveal the more specific sources of comprehension difficulty as viewed by the participant. On the basis of these verbalizations of comprehension difficulties, the following categories were identified:

I. Failure to understand a concept.

II. Failure to understand an idea unit.

III. Failure to understand how one idea unit relates to another.

IV. Failure to understand how different sections of the text fit together.

V. Failure to remember concepts, idea units and the necessary information.

VI. Failure to insert an appropriate cloze response. In this type of error the participant must indicate an awareness of such.

The following section provides a number of specific protocol examples as well as a discussion of these categories.

I. Failure to understand a concept.

1. The term may be novel.

4, P3C2

I can't even pronounce the word let alone know what it is. (ubiquitous)

8, P4C4

What is discrimination learning?

2. The term is known but doesn't make sense in the context.

20, P4C2

The word connection seems to be the one that's blurred right now.

I don't know what he means by internalizing.

13, P3C2

The word's familiar but the definition isn't. (means)

3. Several possible interpretations are possible for the term.

20, P4C2

S: Yeah is there another definition for rule rule yeah or does it mean something different than what I mean you know . . .

Q: So that's a question you're asking . . .

S: Yeah, yeah that's a question yeah I'm asking myself rule learning oh yeah because in the word rule this is because if I had a dictionary here with a rule learning rule like a king rules over his country you know, ok now it's the rule learning seems to me more like a rule like a law and order thing a law the law of learning or law or learning vs learning to dominate so this is why I want to know if there is a difference if that rule means rule for in the sense of law or dominance that's right.

II. Failure to understand an idea unit.

1. The participant can find little or no interpretation, or the interpretation is vague and ambiguous.

20, P4C2

Let's see—pause—well I there's well let's put it this way there's a lot of I don't wanna say there's a lot of of new words but of new series of groups of words grouped together I know what abstract means I know what property means I know what the word stimuli means but when they're in a sentence sometimes like that you know I find the whole thing very abstract. It's hard to to really say what is well I know what's physical terms is it's when it's in a specific sentence maybe that's hard to understand what it means and that's what makes me say that I don't quite understand the sentence. OK it's all these terms although I know what they mean individually.

6, P2C2

It's so vague to me that reversibility of the idea that in thoughts step can be retraced actions cancelled in the original situation restored in the other, I wish I had, I wish they gave us just an example right here.

1, P2C2

From this they're adding on to it and then finally they can grasp and reach out to different things like rattles or toys. I understand the first part of the paragraph, where the child is adapting for the first four months and then but the circular reaction I don't get that. I think I would maybe have to go look it up someplace else to understand it.

I don't see where a box becoming a house and the images falls into the preoperational thought, you know what I mean?

8, P2C2

I'm trying to understand what they mean by a chance matter, sounds strange. It sounds like the child just keeps trying over and over and just sorta fail and try again type of thing which is understandable because they're learning.

16, P2C2

I'm wondering is this people doing this, or is this what the child thinks, or is this what the other people say.

2. The interpretation conflicts with prior knowledge. The interpretation is correct and the reader is aware of the inconsistency.

6, P2C2

Dealing with . . . operations, I must have concrete operations mixed up because as far as I'm concerned logical relationships a child of seven and eight can express himself verbally about logical relationships, I mean, they know the sun comes up you know about that age, oh I don't understand this.

Why would it be eleven or twelve, I must not be getting the gist of the concrete operations if the formal operations only come at eleven and twelve because that's not my idea of . . . formal.

4, P3C2

I could say for instance on the basis of present evidence and current tasks the variation the variance of intelligence of a random sample of eleven year old children was about 225 points IQ points, that doesn't tell me anything, because I can't find, say for instance that on the basis of present evidence, so by doin' this evidence today up-to-date evidence these tests that we're doin' all the time the variance in intelligence of a random sample of eleven year old children of eleven year old children as far as I know IQ only ran from I always thought a hundred was oh about even 85 and above is little above, below average 85 or 100 above is you know above average so the variance in intelligence in a random sample of eleven year old children is 225 points doesn't tell me anything I'm lookin' for a comparison here like between eleven year old children and someone else but there's no comparison.

III. Failure to understand how one idea unit relates to another.

1. The interpretation of one idea unit conflicts with another.

6, P2C2

OK what are they saying. OK that's pretty much straightforward, so what they're saying is the operational child is concerned only with concrete objects and representations of these objects, the adolescent is preoccupied with thinking, OK so what they're saying then is the child isn't preoccupied with thinking but only, but weren't they because back here it says, where is it, where is it, right here it says furthermore he acquires the concept of reversability that is in thought steps can be retraced, actions can be cancelled and the original situation can be restored that, I don't see that as dealing with concrete objects and representations as much as thinking, do you see what I mean, I just oh, OK but what they're saying is dealing with objects. Oh I'd better go through the whole thing again and still can't get it all. Piaget, nice man.

20, P4C2

The definition of rule learning and the analogy that they give at the end. Doesn't seem to make a connection OK we talk about a rule expresses a relationship between two or more concepts rule the change of two or more concepts then the explanation they give doesn't seem to jive.

It's there you can solve a problem that's new to him so a new environment a new problem the environment is thrown at him and he can solve that problem because of the old rules that he has acquired but why is he combining those rules into new ones. OK I, I gotta see that I might I might not be far from the truth but I need more information.

2. The relationship between the idea units is not clear.

6, P2C2

I don't understand is he has a more advanced notion of classes in an abstract sense he can sort objects on the basis of characteristics as shape color and size now down here they're saying is he can is capable of elementary logical processes but he can only do it applying logic only to the concrete events, can't he use the abstract events in I mean the abstract events or seeing things in an abstract sense in his you know reasoning, why not, I mean if he already has that abstract sense he's developing it, why he can't he use it in his you know applying logic down here I don't understand that why why why what happens in the abstract why is it only concrete that he can you know apply logic to or reason.

16, P2C2

Going on to preoperational thought as far as I I'm concerned what they're saying is preoperational thought they can think of things without actually having the things there they can think of manipulating something or whatever without it actually being there but then what's this with about the bicycle may become an airplane and a box becomes a house what are they thinking.

3. The idea units appear to be similar, and the reader cannot detect a difference.

2, P1C2

OK there was two things. I don't know the difference. I just wanta get one on one side and one on the other side. It's still fuzzy but maybe explain it a little more as I go on and if not I'll just go back.

15, P1C2

It sounds the same though, the simple level and action as they are performed. I don't see the difference. Sounds the same. I just talk about actions and how they are performed.

IV. Failure to understand how sections of the text fit together.

6, P4C4

I'm not sure what they're talking about here. I have a vague idea. It's vague. I couldn't say what it's about. Concept learning is.

I'm not sure if I understand the paragraph.

1, P4C4

I am really confused. I'm making it hard for myself. Doesn't make sense to me. Began getting confused when they talked about connection and the stimulus response learning and the example threw me a little. On the whole the whole thing has got me confused.

4, P1C4

Hm, I don't know. I'm tryin' to understand it ah the the directive function. I don't have a clue what the directive function was now that, ahm now I've gone over the interpretive, interpretive function and I don't have a clue what that is either.

These four primary sources of difficulty related primarily to the understanding of the text. Type V difficulties dealt with the participants' failure to remember the text.

V. Failure to remember concept, and idea units, and the necessary information.

4, P3C2

Tryin' to think how I'm gonna remember this it's all samplin' stats, stats samplin', so samplin' variations is the variance.

6, P2C2

OK (. . . connection . . .) yeah more so but I had to go over that. All right stage of concrete operations during this period the deficiencies, what were the deficiencies again?

20, P4C2

When I come to the end of the thing my mind is a blank, basically can't even remember a word or anything like that or a . . .

VI. Failure to insert an appropriate cloze response. In this type of error the participant must indicate an awareness of such.

Both verbal and nonverbal indicators were considered. These indicators consisted of monitoring attempts and verbal statements indicating the participant recognizes a difficulty has occurred.

8, P2C4

I don't like that. I said the first four months they begin to be coordinated.

Table 17 presents a summary of these types of comprehension difficulties.

For purposes of group comparison, Type I and II difficulties were labeled as ideational difficulties, Type III and IV were labeled as relational difficulties, Type V difficulties were viewed as mnemonic difficulties and Type VI difficulties were labeled as cloze errors.

Although comprehension difficulty VI was apparent only in the C4 condition the remaining difficulties I-V occurred in all concurrent verbalization conditions. This framework for categorizing comprehension failures was then utilized for comparison of the high and low recall participants. The analysis of these results follows.

Comparison of High and Low Recall Participants

Table 18 provides a breakdown of the types of difficulties for the high and low recall participants. As indicated by the data both the high and low recall participants experienced comprehension difficulties and the full range of difficulties was apparent for most subjects for at least some of the time. The total number of difficulties related to Type I, II (ideational), Type III, IV (relational) difficulties did not differ appreciably across groups (total ideational plus relational C2 $U = 10.5$ $p > .345 < .421$; C4 $U = 13$ $p = .579$). Furthermore,

Table 17

Summary of Types of Difficulties

Types	Definition
A. Ideational	
I	Failure to understand a concept.
II	Failure to understand an idea unit.
B. Relational	
III	Failure to understand how one idea unit relates to another.
IV	Failure to understand how different sections of the text fit together.
C. Mnemonic	
V	Failure to remember concepts, idea units and the necessary information.
D. Cloze	
VI	Failure to insert an appropriate cloze response.

Table 18

Types of Difficulties Recognized by Groups

High Recall Group	Type I	II	III	IV	Total I-IV	V	Total I-V	Total VI	Low Recall Group	Type I	II	III	IV	Total I-IV	V	Total I-V	Total VI
Par 16									Par 8								
P2C2	2	14	2	0	18	4	22		P4C2	1	2	3	1	7	0	7	
P4C4	1	4	2	3	10	0	10	44	P2C4	1	2	6	0	9	1	9	37
Par 1									Par 5								
P2C2	1	0	0	1	2	0	2		P1C2	2	5	3	1	11	1	12	
P4C4	4	1	0	2	7	0	7	31	P3C4	6	4	0	0	10	1	11	50
Par 20									Par 7								
P4C2	4	7	0	3	14	0	14		P3C2	3	2	3	1	9	1	10	
P2C4	1	2	0	1	4	0	4	17	P1C4	0	3	0	1	4	1	5	28
Par 2									Par 10								
P1C2	0	2	4	0	6	1	7		P3C2	0	1	0	2	3	0	6	
P3C4	0	1	3	1	5	4	9	57	P1C4	0	1	0	0	1	0	1	51
Par 4									Par 21								
P3C2	1	2	2	1	6	1	7		P2C2	0	2	0	0	2	0	2	
P1C4	0	2	0	1	3	1	4	28	P4C4	1	0	0	5	6	0	6	17

the groups did not differ in the recognition of Type V (mnemonic) difficulties (total mnemonic C2 $U = 11$ $p = .421$; C4 $U = 13$ $p = .579$) and Type VI difficulties ($U = 12$ $p = .50$). As would be expected the two groups also did not differ appreciably in the sum total of ideational, relational and mnemonic difficulties (I-V) (C2 $U = 9.5$ $p > .274 < .345$; C4 $U = 12$ $p = .50$).

These findings would suggest that the two groups were not significantly different in their realization that they were experiencing comprehension difficulty. This realization was also evident across conditions. Comparisons of the total Type I-IV difficulties across conditions (C2 compared to C4) used the Wilcoxon Matched-Pair Signed-Ranks Test revealed no difference across conditions (Group 1 $W = 4$ $p > .05$; Group 2 $W = 6$ $p > .05$). These results would suggest that both groups were similar in their ability to recognize the importance of ideational and relational understanding in both the C2 and C4 conditions. In addition, the examination of Type V errors would suggest that the two groups did not differ appreciably across conditions in their ability to recognize the importance of remembering the information.

This pursuit of understanding and remembering was evident for both conditions and all participants. Particularly with reference to the cloze condition, it would not appear, as Shanahan, Kamil and Tabin (1982) have suggested, that the cloze procedure is not sensitive to intersentential relationships. If this would be the case, relational and ideational difficulties would not have been as evident in both the C2 and C4 conditions. This notion is further supported by examining the location or point at which the participants perceived the comprehension difficulties as occurring. Examining Table 19, it becomes apparent that as a whole these difficulties were occurring during the initial phase of the cloze completion task. Most instances of ideational and relational error detection occurred while the participants were completing the cloze version of the task, while the incidence of mnemonic V errors tended to occur after the cloze component of the condition was completed.

Although all participants appeared to be sensitive to comprehension failure, in some instances in both the C2 and C4 conditions participants failed to recognize a comprehension failure had occurred. Misinterpretations included both comprehension noncloze (unknowingly interpret text incorrectly) and cloze failures (unknowingly insert inappropriate term).

The following would be an example of a comprehension noncloze misinterpretation:

> 1, P2C2
>
> I don't know, seems like they're saying well they might develop and they might not develop. It makes it hard. I think it's hard 'cause like I can understand how they're adapting and they're learning new things and they keep building on to it and forming new relationships and things but the two words chance matter makes it seem like they're saying well this is what the baby could do but then again the baby might not do this it's all a matter of chance but I think all kids learn no matter what even if they're still in the slums and their parents don't love them or something. They're still learning even though they're not learning as fast or as much.

Mann Whitney results for the C2 condition (U = 11 p = .421) and the C4 condition (U = 13 p = .579) indicate no significant difference between the two groups in misinterpretations. Furthermore U = 6 p = .111 for misinterpretation cloze responses indicate the two

Table 19

Location of Type I to V Comprehension Difficulties

	High Recall Group						Low Recall Group				
	Type I,II,III,IV Difficulties		Type V Difficulties				Type I,II,III,IV Difficulties		Type V Difficulties		
	Within	Following	Within	Following	Total Difficulties		Within	Following	Within	Following	Total Difficulties
Par 16 P4C4	7	3	0	0	10	Par 8 P2C4	8	0	0	1	9
Par 1 P4C4	2	5	0	0	7	Par 5 P3C4	10	0	0	1	11
Par 20 P2C4	4	0	0	0	4	Par 7 P1C4	4	0	0	1	5
Par 2 P3C4	5	0	1	3	9	Par 10 P1C4	0	1	0	0	1
Par 4 P1C4	3	0	0	1	4	Par 21 P4C4	4	2	0	0	6

Within: The difficulties occurred while the participant was completing the cloze version of the task.

Following: The difficulties occurred after the participant had completed the cloze version of the task.

groups did not differ appreciably in their tendency to not notice cloze failures when they should have.

Considering the group (N = 21) as a whole, this was further supported by the correlation coefficients. Recall performance (Total Text Specific plus Entailed Recall Responses) with noncloze misinterpretation in the C2 condition was rs = -.2749 p = .114 and C4 condition rs = -.1455 p = .265. As expected there appeared to be little or no relationship between recall performances and noncloze misinterpretation.

This section has dealt with the recognition and nonrecognition of comprehension failures. The following segment involves an examination of decisions for the resolution of comprehension failures.

Deciding Whether or Not to Attempt a Resolution: Results and Discussion

In some situations participants noted that a difficulty existed, but did not initiate any remedial action. The decision appeared to be based on importance of the central meaning of the text and was related to the participant's perception of the criterial task. These decisions were related primarily to the cloze (C4) condition but also occurred in the noncloze (C2) condition.

The indepth analysis of performance of high and low recall participants shows that although both groups experienced comprehension difficulties, remedial action was not initiated in all situations. This was particularly evident in Type VI errors. Some examples of failure to initiate or attempt a resolution are:

1, P4C4

The pronoun each takes a ______ verb. I don't think that blank is very important. I get the idea I know what they're saying. They're saying that by learning ideas or by having certain ideas such as gases expand when heated you're learning rule learning.

I don't think that's very important, just connecting a word for highlight the effects.

2, P3C4

There are many, and a comma, blank must just be there are many again and a little word, that's not going to make any difference to my understanding. That is an aggravating blank. We already get the idea of it.

13, P1C4

Omit those because made sense without them.

6, P2C2

OK a child acquires the concept of conservation and becomes more aware of the principle of invariance. Hopefully they'll explain these to us. . . .

They didn't mention the other two things again at all so you, I, wouldn't even think about these again because they you know they didn't think enough to explain them. They really can't be very important cause not everybody's gonna know what they are and I don't.

As is evident, particularly in the final example, importance is determined by both the relevance to the central meaning of the text and the extent to which the author is perceived to have chosen to explain and elaborate the concept.

In the case where the participant would just omit, particularly in the cloze condition, the difficulty and not return to the error, this was classified as an omission. Verbalized decisions not to resolve the difficulty based on perceived lack of importance were classified as nonapplicable.

The incidence of omissions and nonapplicable responses occurred in both groups and did not appear to differ appreciably across groups. Participant 21 who found the cloze condition very difficult tended to commit a relatively high number of omissions especially in response to Type VI difficulties. This may have contributed to her relatively low recall performance (see Table 20). Considering the group as a whole, the possibility was further supported by the insignificant correlation coefficients found for Total Text Specific plus Total Entailed with Non Applicable (C2 condition rs = -.0571 p = .403; C4 condition rs = .0035 p = .494). Similarly low correlation coefficients appeared in terms of Omissions. In the C2 condition the correlation with recall performance was -.1511 p = .251 and in the C4 condition the coefficient was -.2208 p = .168.

Once participants decided to attempt to resolve the comprehension difficulties, a large variety of strategies were initiated. These strategies and corresponding illustrations will be discussed in the following sections.

In general the participants' decisions to take action once comprehension difficulties were recognized appeared to be based on the subject's evaluation of the importance of the error or to the perception of the criterial task. This was reflected by comments such as:

> 2, P3C4
> That is a big blank because I don't really understand that part of it.

In this section the decision for action or no action following a comprehension difficulty was discussed. In the next section the actual strategies that participants initiated will be outlined and described.

Table 20

Nonapplicable and Omission Responses: High Recall and Low Recall Participants

	High Recall Group			Low Recall Group	
	Non-applicable	Omissions		Non-applicable	Omissions
Par 16			Par 8		
P2C2	0	0	P4C2	0	0
P4C4	2	0	P2C4	0	0
Par 1			Par 5		
P2C2	0	0	P1C2	1	0
P4C4	1	0	P3C4	1	2
Par 20			Par 7		
P4C2	0	0	P3C2	0	1
P2C4	1	0	P1C4	1	1
Par 2			Par 10		
P1C2	0	0	P3C2	0	0
P3C4	0	0	P1C4	0	1
Par 4			Par 21		
P3C2	0	0	P2C2	0	2
P1C4	1	1	P4C4	0	11

Omission: Omit the difficulty and not return.

Nonapplicable: Verbalized decision not to resolve the difficulty based on perceived lack of importance.

Selecting and Implementing Remedial Action: Framework for Analysis

After deciding to initiate action following a comprehension obstacle, participants demonstrated considerable variability in use of intervention strategies. In this section these strategies will be individually described and exemplified. Although some of these strategies have been identified in the previous literature (see Table 8, Chapter IV), the following discussion will attempt to clarify and elaborate these and others utilized by the participants. Table 21 presents a summary of the remedial strategies which were the most evident.

Table 21

Summary of Remedial Strategies

Strategies:	Suspend Judgement
	Tentative Interpretation
	Analysis of Alternatives
	Grammatical Application
	Orally Reread the Current Idea Unit
	Orally Reread the Previous Context
	Orally Reread the Following Context
	Scan the Current Idea Unit
	Scan the Previous Context
	Scan the Following Context
	Restating the Present Idea Unit
	Restating the Following Context
	Restating the Previous Context
	Conceptual Binding
	Experiential Utilization
	Intuitive Action
	Reattempts

Suspend Judgement

This strategy, commonly used by all participants, in all conditions, was signalled by a shift of focus. The reader would find difficulty making an interpretation and move on in hope that the failure may be clarified later. In the cloze condition this was usually signalled by a tentative ommission, however the reader would eventually return to the source of difficulty.

In the example below the participant restates the difficulty and decides to read on.

4, P3C2

> If all the answers of a defined universal set are known, then the variance is known if all the measures of a defined universal set okay so if all the component parts of view like of a set are known then the variance is known tells me nothing so far. More likely however all the measures of view are . . .

20, P2C4

> Yeah, or to be maintained but I don't even understand the word maintained here. I mean I understand maintaining but what I don't understand the sentence he can cause interesting sounds to be maintained but you know for a long period of time you know so I wasn't sure what the main what the word maintained means so what that's why I can't really find out the word that goes there . . . circular . . . to form . . . schemes . . . begins to look for hidden objects.

The notion of suspending judgement also relates to one's expectations of the text, and the hope that through reading on, more information will be available to help clarify the difficulty. For example:

26, P4C2

> There's four types of learning and they are blah, blah, blah, blah, and I don't know what they are. I tried to understand each of the four types of learning as I was reading them slowly I realized that I wasn't getting anything, and farther ahead and I just came back and through it and I said well I knew there are four types of learning and you know they would be explained later on.

Individuals also tended to differ in what they expected from the text or how they viewed themselves interacting with the text.

Some tended to move on in hope that something would happen:

> 6, P2C2
>
> I'm going on, I'm going on, I'm gonna leave that for a minute if I come back something will happen maybe. Dealing with the verbal expressions of logical . . .

while other participants assumed a much more active stance, and had a clearer intention of what they could do if they went on.

> 20, P4C2
>
> OK, I read the first sentence. I'm not sure if I understand it right but again I'm gonna carry on to find the most meaning of the sentence.

In some cases of this strategy use the reader did not state an intention to return to the source of the difficulty. This was especially apparent in the C4 condition, in which the participant would shift focus and then at a later point return to the difficulty. If the reader did not return to the error and had not initiated any action the error was clarified as an omission.

Tentative Interpretation

Whereas in some cases participants were reluctant to form an interpretation and just suspend judgement, in other cases participants would form a tentative interpretation and hope to confirm the interpretation later. This form of tentativeness was usually signalled by a pending question in which the reader would state his uncertainty for an interpretation but would settle for that particular interpretation for the time being.

The source of the interpretation could be from the previous part of the text, such as indicated by the following examples.

8, P2C4

Yeah. Okay it says the first quarter the first four months show the start of something. On in the sentence before they talking about coordination so during the first four months they're probably beginning to control maybe more coordination.

20, P2C4

Four months and whatever . . . reaction develop. Now between four and I can't really tell how many months that is even by reading it there's not enough clues I know because we were talking the first two years in the first four months so between four and twenty four months but well see it might not be twenty four months . . . develop . . . environment . . . can cause.

19, P4C4

It's talking about a process and a certain type of process, but I don't know if it's the right word.

An inference based on the text and prior experience:

20, P4C2

Yeah, resolving, revolving around the word connection although the learning of each thing was response connection is a simple example of a stimulus response learning. The connections tend to interfere, okay what is connection? is it stimulus response? I think in stimulus response is qualified as being a connection I think this is what it is I'm not sure but I think that I'll just write . . . connection is defines stimulus.

or a guess:

8, P2C4

I'll put seven. I don't know why. Maybe I'll go on and find out what they learn in the next stage and then I'll come back.

What is of primary concern in the participants' use of these first two strategies is the element of tentativeness; tentative in forming an interpretation and tentative in accepting an interpretation as being appropriate.

Analysis of Alternatives

Another strategy relating to the pursuit of tentativeness however normally resulting in either a tentative or nontentative judgement is the analysis of alternatives. This strategy, predominantly applied in the cloze condition, consisted of the individual attempting a number of different items and narrowing the selection. For example:

> 16, P4C4
>
> The necessary rules which have been previously learned are— It's not quite the right word (What are you thinking about?) are studied, are taken part, are examined, are remembered, are broken down, trying to think of a word that means that, are examined, maybe I'll put that.
>
> 19, P4C4
>
> It's either the response or the solution.

Grammatical Application

Another strategy primarily restricted to the cloze condition was the participant's knowledge of language to support the interpretation.

> 20, P2C4
>
> Stage, yeah it makes sense. During the latter part of this stage the child moves from this series of sections, from this set of actions, no set is not right. It doesn't make sense from this . . . stage, moves from this stage, okay. During the latter part of this stage the child moves from this ______. I'm seeing, it's not set here because if there was a set the word action would be plural.
>
> 8, P2C4
>
> I should say in an instrumental way, or I'm not sure of my grammar here in or on.
>
> Change from on to in.
>
> It's me that doesn't know enough grammar. I'm not sure if it's on or in and I act upon his environment on an instrumental way or in an instrumental way, might not be either but anyway.

Refer to Previous, Present or Following Information

Evident in a large number of attempts to resolve the comprehension difficulty were strategies involving the reference to previous, present or following information. This was most prominent in the rereading or scanning of previous, present or following idea units. The retelling of the present, previous or following context or idea units was also categorized as a reference strategy, but was considered to be somewhat more complex than other referring strategies included here. A discussion and examples of these will follow.

When orally rereading the current idea unit the participant would refer to the difficulty and reread the present idea unit:

> 4, P3C2
>
> Error variance is random variance. It is the variation in measures due to the usually small and self compensatin' fluctuations of measures now here, now there, now up, now down, tells me nothing, error variance is the fluctuation or varyin' of measures that are due by chance, error variance is random variance, it is the variation in measures due to the usually small self compensatin' fluctuations of measures.

or if orally rereading the previous context, just make a statement to that effect, and begin rereading the previous context:

> 4, P3C2
>
> . . . trouble comprehending it. I'd better read over.
>
> 20, P2C4
>
> But I gotta say, I don't quite understand. The passage is not quite as clear as the other passage so I'm gonna read it again very quickly.

Orally rereading the following context was usually observed when the participant had returned to a difficulty and reread the text following the error.

> 20, P2C4
>
> Okay now there's probably here in the sentence here I said to myself what I thought this is. There's the answer. Now I've got it, but it was blurred a bit. Now I've gotta really stop or go slowly over that. . . .

In many instances reference was made to other parts of the text but readers did not tend to orally reread the text as would be expected. Rather, participants would typically employ a quick scanning of the designated part of the text.

When scanning the current idea unit, the participants referred to a part of the current idea unit, however the unit is not orally reread or restated.

> 20, P2C4
>
> During the latter part of . . . stage . . . from these . . . I gotta go back.

Similarly when scanning the previous context the reader would refer to a component of the text read prior to the current idea unit.

> 6, P3C2
>
> I can't get it across to me. It's there's no error variance at all systematic variance, systematic variance, gonna have to look back here to the second page. Perhaps the most general way to classify variance is systematic due to some . . .
>
> 4, P1C4
>
> If I look up here I might find something for a word that fits in there.

When scanning the following context the participants would refer to the text past the point at which the difficulty may have occurred. Again the text would not be orally reread or restated. This was observed when the individual had returned to a difficulty and scanned the text following the difficulty.

> 4, P1C4
>
> Imaginin' and relatin' the feelings and reactions of other ahm individuals I'm gonna use the word individuals because I'm not sure if they're still talkin' about children that are, they might be talkin' about a valid events or whatever it's children. I just saw it right here (laughs) 'cause down here young children, it's gonna be children.
>
> I fi, I find if I, if you look down here you can okay where am I at? Okay these strategies you're talkin' about strategies here of prediction, predictions and that so if the list includes blank anticipated consequences surveyin' possible alternatives, recognizing and predictin' now if you look down here and you see anticipating, surveying and recognizing.

A less text dependent and commonly used strategy was the restating of the present idea unit or the previous or following context.

The restating of the present idea unit is illustrated by the following example:

> 4, P3C2
>
> Okay, so error variation right at the top you get the idea that it's important, error variance is the fluctuation or varyin' of measures due to chance so it's the variations and measures variance that measures due to chance, okay.

and in some instances the following context is restated. This was observed when the participant had returned to a difficulty and restated the text following the difficulty.

> 4, P3C2
>
> A self compensation of measures, nowhere, now there . . . okay, probably how these variations, how these samplings, how things in nature occur, one minute they're here one minute they're there, it's down the next minute and up the next minute, it's up that sorta thing, it's the measure of error variance.

The restatement of the previous context is illustrated by the following:

> 4 P3C2
>
> . . . made and natural influences, here they're saying that these measure often happen by chance, so error variance always

> happens by chance. Everything in the world . . . dictionary . . . this great big book with everything in it that has always happened okay all one needs to do is look . . . occurrences. So there's no way that a chance occurrence can change that everything is accounted for . . . error variance. So error variance is anything that occurs that happens by chance, we have no control over it and we cannot do anything to change it. Boy.

Whereas the notion of referring to the previous, following or present information involves a more strict adherence to the text, the utilization of conceptual binding involves more of a reconstructive activity within the confines of the text.

Conceptual Binding

Conceptual binding is a strategy through which the reader attempts to resolve the comprehension difficulty by conceptually chaining the text together through reasoning.

The reasoning can be verbalized and directly supported by the text, or in the case of a logical inference, the information not stated by the author is generated by the reader. However, in the case of a logical inference, the relations used to generate the inference are not stated by the reader and there is little or no elaboration. This notion of conceptual binding is supported by the following illustrations:

> 4, P1C4
>
> You settle on functions there can you tell me what you were thinking to settle on that?
>
> Ahm, pro, okay ahm again I'm lookin' for a word that'll fit into it ahm functions, ahm probably 'cause there, the whole paper is all on functions all ahm functions of language so it's it's just that it's all on functions this one, this one here where I used the self maintaining use of language ahm language. The only reason I used language is because they're talkin' about functions of language and ah that's why.

It is concerned with the actions of the individual of the children. Guess I'm only usin' the word children ahm because they're sayin' here that they're startin' with the children's thinkin' to examine them the children's thinkin' in the introduction. So they're probably gonna be talkin' about children all through here.

20, P4C2

The word inhibit memory loss that group of words, okay 'cause we have been talking about forgetting vs learning so therefore to stop forgetting or to cancel out forgetting we have to do something else in order to learn which is you know to acquire knowledge and to respond to the stimuli.

20, P2C4

I wish I knew it's the . . . okay he takes his own . . . as an . . . thinks . . . thinking, to think about thinking, that's an operation and we were talking about formal operations, it's more formal, it's more advanced, he takes . . . thinks . . . thoughts . . . logic . . . ideas . . . thoughts . . .

2, P1C2

Reasoning develops from reporting, so we have to have reporting first, and then the reporting comes. He makes sense of it all.

Other comments which were classified as reflecting conceptual binding but including less stated textual and conceptual support are illustrated by the following:

16, P2C2

He also understands relationships between classes and subclasses and can recognize that an object can belong to both classes simultaneously. It can be red and it can be a truck too.

19, P4C4

Well they're talking about making a new rule. So that a new rule emerges and is learned.

2, P1C2

Okay, that's what he thinks.

3, P4C2

In this section we're going to learn how the child learns, the meaning of the conceptual middle.

Experiential Application

Whereas in conceptual binding the reader attempts to logically relate and integrate the text, in the use of an experiential strategy the participant attempted to resolve the comprehension failure by relating aspects of the text to prior knowledge through the use of examples, personal experiences and illustrations.

> 20, P2C4
>
> Let's see, if it does make sense . . . child . . . action . . . scheme, okay.
>
> The big key here is differentiated scheme, first of all he can only move his fingers, and then he can see an object and he can take the object separately and then he makes the . . . Initially just grabbing the pencil may be just a reflex action, it's something he's grasping, he's not aware it's a pencil or a soother, it's a pure reflexive action by feeling it's a reflexive feeling, then later on he'll be able to differentiate, he sees the object the pencil. He doesn't know it's a pencil yet he knows there is an object there, could be a cup here, it could be two different things. He can see and without thinking about it he can grab this one, he can grab this one, but he's not thinking about why he's really reaching and then when we talk about further scheme differentiated scheme grasping an object that he can see, means that he sees the pencil, he will grasp the pencil. See we have like a progression. First it's just pure reflex, grab anything, then he can see and he can act. Doesn't mean that he is grasping what he sees. He might see the cup and go reflexively he might grab the pencil but then later on as he becomes more awakened he grows more in his reflexes he can grasp something he is seeing, he sees the cup and he reaches for the cup. That's the conclusion I came to there.
>
> 4, P1C4
>
> Other strategies such as criticism and threats are aimed at a child's status of others other strategies such as criticism and threats are aimed at maintaining the child's status of others ahm it's saying that ahm saying I don't care I don't like that doll anyway is a re, you know it's got blond hair or something like that or if you don't let me use it now I'm gonna hide it on you or something like that. They're saying that this maintains a child's status of others.

6, P2C2

> I oh (. . . fit in . . .) yeah, yeah well I want to see the connection in that. I don't see the connection between the child becomes capable of thinking about doing X rather than actually performing the physical manipulations okay. Speaking about doing X why then do they need to use a cloth as a robe what's with the mental symbols images or words that come into this? Because they if they use a cloth as a robe if they use the bike may become an airplane oh I the bike may become an airplane oh they're not thinking about it they're changing the bike into an airplane as far as they're concerned the bike becomes an airplane. But that's thought, right, but that's thought though yeah I suppose they never really they couldn't have turned the bike into an airplane without thinking about it first.

The essential feature of this strategy is to go beyond the text, and through elaboration and the binding of personal experiences, in an attempt to resolve the difficulty.

Intuitive Action

In some instances, particularly in the cloze condition (C4), the reader would resolve the comprehension difficulty by inserting a term that was more intuitively based. Essentially the participant based the decision on a feeling or a sense of understanding. For example:

> The word just came out naturally.
>
> Okay, it just makes sense.

Reattempts

A final action which cannot be unequivocally called a strategy was a reader's persistent returning to a source of difficulty. This was evidenced by readers returning two or more times to a specific source of difficulty. Tentativeness and high persistance were associated with this action.

In summary of this section, it is apparent that a variety of strategies are used by college level readers to resolve comprehension difficulties. How these strategies were tabulated for purposes of further analysis will be the focus of the following section.

Tabulation of Strategy Use

The incidence of strategy use, relative to each difficulty, was tabulated for each participant. For example, if a participant experienced some difficulty, and in response made a tentative interpretation, and orally reread the previous text, this would be coded in the following manner. First, the type of difficulty would be noted, and the location relative to the idea unit or units and/or the cloze deletion would be specified. Next the actions initiated would each be coded as a single occurrence for the particular difficulty.

In the above example the participant used two forms of action, one incidence of a tentative interpretation and one incidence of orally rereading the previous text. These occurrences were all recorded for each of the 21 participants in the C2 and C4 condition. Tables 18 and 19 present a summary of the incidence of strategy use for the high and low recall participants. The following section will present a discussion of the major findings, both in terms of the total group (N = 21) and the high and low recall groups.

Selecting and Implementing Remedial Action: Results and Discussion

Both the high recall and low recall participants utilized a wide number of strategies in an attempt to resolve the comprehension difficulties (see Tables 22 and 23). The utilization of many of these

Table 22

Summary of Incidence of Strategy Use: High Recall Participants

	Suspend Judgement	Tentative Interpretation	Reread Current Idea Unit	Reread Previous Context	Reread Following Context	Analyze Alternatives	Conceptual Binding	Experiential Utilization	Grammatical Application	Restate Current Idea Unit	Restate Previous Context	Restate Following Context	Scan Previous Context	Scan Following Context	Scan Current Context	Intuitive Action	Reattempts
Par 16																	
P2C2	10	5	11	7	3		8	10	1	3	3	2	2	4			6
P4C4	52	13	36	7	1	16	22	8		1	2		4	3			38
Par 1																	
P2C2		2	1	1			6	2									
P4C4	10	8	22	2		10	24	14	3	12	2		3	2	2		2
Par 20																	
P4C2	9	3	11	6			11	8	1	1	1		1	2			4
P2C4	3	8	6	2	1	2	9	2	2	5	1	1	6			1	3
Par 2																	
P1C2	5		2	6			4			1			3	5			2
P3C4	38	15	13	38	1	19	30	7	9		5	2	8		1		33
Par 4																	
P3C2	2	1	7	3			1	2		6	5	1	2				
P1C4	17	4	12	5		7	8	5	7	4	1		3	5			

Table 23

Summary of Incidence of Strategy Use: Low Recall Participants

	Suspend Judgement	Tentative Interpretation	Reread Current Idea Unit	Reread Previous Context	Reread Following Context	Analyze Alternatives	Conceptual Binding	Experiential Utilization	Grammatical Application	Restate Current Idea Unit	Restate Previous Context	Restate Following Context	Scan Previous Context	Scan Following Context	Scan Current Context	Intuitive Action	Reattempts
Par 8																	
P4C2	3	4		1		1	1	2	3	2	3			8			
P2C4	10	17	22	10	6	6	13	4	13	10	6		2		1		3
Par 5																	
P1C2	4	4						3		1			3	1			1
P3C4	12	9	31	4		11	13	3	7	4			14	3		1	22
Par 7																	
P3C2	2	1	1	1	1			3		7	1			4			
P1C4	5	8	21	4		19	2	2	7		1		1	5	1	3	3
Par 10																	
P3C2	1			1		1				2	1						
P1C4	27	11	58	6		18	3	3	12	1			2	3		1	24
Par 21																	
P2C2																	
P4C4		8						1	2				1	1			

strategies by readers is certainly supported by previous research findings, most notably Jenkinson (1957) and Anderson (1981).

However, with direct reference to monitoring, the primary strategies that have been recognized are rereading the previous context or current sentence (Alvermann and Ratekin, 1982), lookbacks (Alessi, Anderson and Goetz, 1979), looking forward to see if the information will be consistent with or can be predicted by present understanding (DiVesta, Hayward and Orlando, 1979; Markman, 1981), formation of a pending question or tentative hypothesis (Collins, Brown and Larkin, 1981), suspend judgement (Collins and Smith, 1980), drawing on prior knowledge to bridge the gap in understanding (Baker, 1979), personal identification (Alvermann and Ratekin, 1982) and analysis of alternatives (Collins, Brown and Larkin, 1981).

Although these previous studies differ methodologically from the present investigation and the findings may not be directly comparable, the findings are similar enough to contribute to the credibility of the findings of the present research. For instance, Alvermann and Ratekin (1982) used a retrospective questionnaire procedure, in which participants were required to talk about what they had done in an attempt to study for an essay exam or a multiple choice test. According to these researchers, a number of the comments related to and could be categorized as personal identification. This notion, particularly with reference to the experiential strategy was also evident in this present study. However, due to the possible limitation of the Alvermann and Ratekin (1982) study both in terms of the use of an extensive retrospective procedure and problems of definition, what was meant by personal identification and how this related to the monitoring process, could not be clearly delineated.

The credibility of the experiential strategy is further supported by the findings of a previous study conducted by Baker (1979). However, the methodology of the Baker (1979) study differed considerably from the present investigation. Whereas concurrent verbalization was a primary procedure in the present investigation, the Baker (1979) study primarily utilized an error detection paradigm in conjunction with retrospection. Baker (1979) found the most frequent monitoring procedure utilized by college students was to draw upon prior knowledge to supplement explicitly presented information. However, since the study used an error detection paradigm in which the errors consisted of deliberately inserted text inconsistencies, this procedure was primarily used as a fix-up strategy to remediate experimenter imposed text difficulties. The extent to which participants tended to use this strategy was inferred from their recall protocol, consequently the degree to which this strategy was actually used to remediate a comprehension difficulty was not specified.

In the present investigation, difficulties were initiated by the reader, and the use of an experiential strategy was inferred from the participant's verbalizations as opposed to the recall performance. Furthermore, in this study, participants appeared to use this strategy more for the purpose of embelishing and relating the text to personal experience, rather than, as Baker (1979) suggests, for the purpose of supplementing missing information.

The use of lookbacks in this study, essentially referring to scanning the previous text was significantly related to recall performance only in the C4 condition (see Table 24). However, this strategy failed to differentiate between the high and low recall participants. The use of rereading, both previous and current information, differentiated the two groups in the study, but only in the C2 condition (rereading previous context U = 1.5 p < .01; rereading current idea unit U = .5 p < .01). The two groups did not differ appreciably in the use of these strategies in the C4 condition. This could be due to the appreciable increase of the usage of these strategies by the less successful group in this case. Two other strategies, restate current and previous context, were also found to be significantly related to recall performance but again only in the C4 condition (see Table 23). Again the two groups did not differ appreciably in the use of these strategies.

The examination of between group performance in the use of oral rereading current context (U = .5 p < .01) and oral rereading previous context (U = 1.5 p < .01) reveals that the cloze condition may have encouraged the low recall participants to utilize more of the strategies used by the high recall group in an attempt to resolve the comprehension difficulties. Essentially the cloze condition with reference to rereading may have encouraged the low recall group to act more like the high recall participants.

Two strategies, conceptual binding and experiential utilization, were found to relate consistently to recall performance in both the C2 and C4 condition. Although these procedures have been cited as relevant action in the comprehension of text, except for the research by Baker

Table 24

Spearman Rank Correlation Coefficients (rs) between
Recall and Strategy Use: Total Group

	C2	C4
Conceptual Binding	.418*	.515**
Experiential Utilization	.372*	.404*
Restate Current Idea Unit	.264	.423*
Restate Previous Context	.216	.464*
Restate Following Context	--	--
Reread Current Idea Unit	.721**	.378*
Reread Previous Context	.323	.140
Reread Following Context	.238	.181
Scan Previous Context	.332	.362*
Scan Following Context		
Scan Current Context	--	--
Suspend Judgement	.267	.308
Tentative Interpretation	-.047	.224
Analysis of Alternatives	-.231	.121
Grammatical Application	--	-.049
Intuitive Action	--	-.063
Reattempts	.093	.356

* >.01 ≤ .05
** ≤.01

(1979), the use of these procedures to remediate comprehension difficulties has been rarely identified as an important component of the monitoring process. A number of factors could account for this. First, this study utilized college students and high level college reading material. Other studies tended to use younger subjects, as well as less technical material. On the one hand, these younger students may not have had the cognitive ability to utilize the higher level strategies apparent in this study and/or the reading material may have been so readily comprehensible that it failed to trigger these higher level strategies. Secondly, because of the nature of the errors selected in studies using the error detection paradigm, i.e., text based as opposed to reader based inconsistencies (Reis and Speckman, 1983), the difficulties would be more amenable to resolution through the use of more text specific strategies, such as rereading and lookbacks. Essentially the reading situation may have been structured in such a manner as to inhibit the use of the higher level strategies. Third, the readers in these previous studies did not self select the sources of difficulty and consequently may not have felt the need to use conceptual and experiential strategies in an attempt to resolve the comprehension difficulties. And fourth, the readers in the present study were free to utilize different strategies while they looked back or reread the text and these were reflected in their concurrent verbalizations. Except for Jenkinson (1957) and Olshavsky (1976-1977), the researchers in these previous studies only had access to the observable indicators of the strategy use, or as is the case of Baker (1979) retrospective reports and a recall measure, and did not have more direct access to the underlying strategic action involved in rereading and lookbacks. Thus, the fact that the underlying strategies involved in lookbacks and rereading in these previous studies were not examined by these researchers, experiential and conceptual strategies could have been utilized, but were not recognized as such by the researchers.

In this section an attempt was made to identify and delineate the specific remedial strategies used by participants to resolve comprehension failure. However, it was readily apparent that such strategies were rarely applied in isolation. Most often subjects would combine a number of these strategies in their resolution attempts. In an attempt to examine the qualitative nature of these patterns, some specific strategies were combined and reflected broader categories of action.

Related and Expanded Categories of Remedial Action

For purposes of a more global trend analysis, i.e., assessment of patterns of strategic action, and to compare these findings to previous research, selected strategies were combined into more global categories. The basis for these groupings was determined by both common traits and previous research.

These strategies if examined more closely can be conceptualized into a number of broad categories. Suspending a judgement and forming a tentative interpretation relates primarily to the notion of tentativeness. The nine following strategies, orally rereading current, previous or following context, reference to previous, current and following context, and the restatement of previous, current and following information can be regrouped into three larger more global strategies of current reference, previous reference and following reference. This regrouping is predicated not so much on whether the participants reread, restate or refer, but rather on the basis of whether the focus of attention is on the specific idea unit in question, or the previous or following text (Alessi, Anderson and Goetz, 1979; Baker and Anderson, 1982; Garner and Reis, 1981; and Baker, 1979).

However, the analysis of the comprehension failures of the participants in this study showed that many of these difficulties were not isolated to a specific idea unit. Consequently, categories of relevant remedial action needed also to reflect attention to different aspects of the text. Thus, even though it is recognized that rereading, restating and scanning may contribute to the comprehension monitoring process, the critical component identified by this study is examination of attention to previous, present and following text. Moreover, the results here suggest that the difference between rereading, restating and scanning may not add appreciably to the qualitative analysis of the data.

It should be further noted that through examining the incidence of restating following context, scanning following context, and scanning current context in the C2 and C4 condition, the responses were so few that the resulting correlations could not be interpreted meaningfully. It was determined that through the combining of these numeric values, more meaningful interpretations may be possible.

The two strategies, conceptual binding and experiential utilization, were left intact because these two strategies tended consistently to correlate with recall performance in both the C2 and C4 conditions (see Table 23). Furthermore, with the exception of the experiential strategy in the C2 condition, these were the only two strategies that tended to discriminate consistently between the high and low recall participants (Conceptual C2 $U = .5$ $p > .008 < .004$; C4 $U = 4$ $p = .048$; Experiential C2 $U = 9$ $p = .274$; C4 $U = 3.5$ $p > .048 < .028$).

Two strategies, analyzing alternatives and grammatical application, were primarily restricted to the C4 condition. These strategies rarely if ever emerged in the C2 condition, and it was felt that these should not be combined with other cross condition strategies. Analyzing alternatives and grammatical application were combined into the category, incidental cloze strategies, and were used in the analysis of the C4 condition. Another factor, reattempts, which occurred in both the C2 and C4 condition, was retained intact. Although this factor was not a strategy as such, it did reflect a persistence factor. This factor was retained as incidental information. The intuitive action strategy, because of infrequency, was retained as a general strategy and was also used as incidental information. Figure 3 represents a summary of the expanded categories.

Utilizing these expanded categories, the incidence of strategy use for each participant pertaining to each expanded category was summed, and new tabulations were included in subsequent analysis. For instance, referring to Table 22, participant 16 in the P4C4 reading situation used the strategy reread previous context seven times, restate the previous context two times and scanned the previous

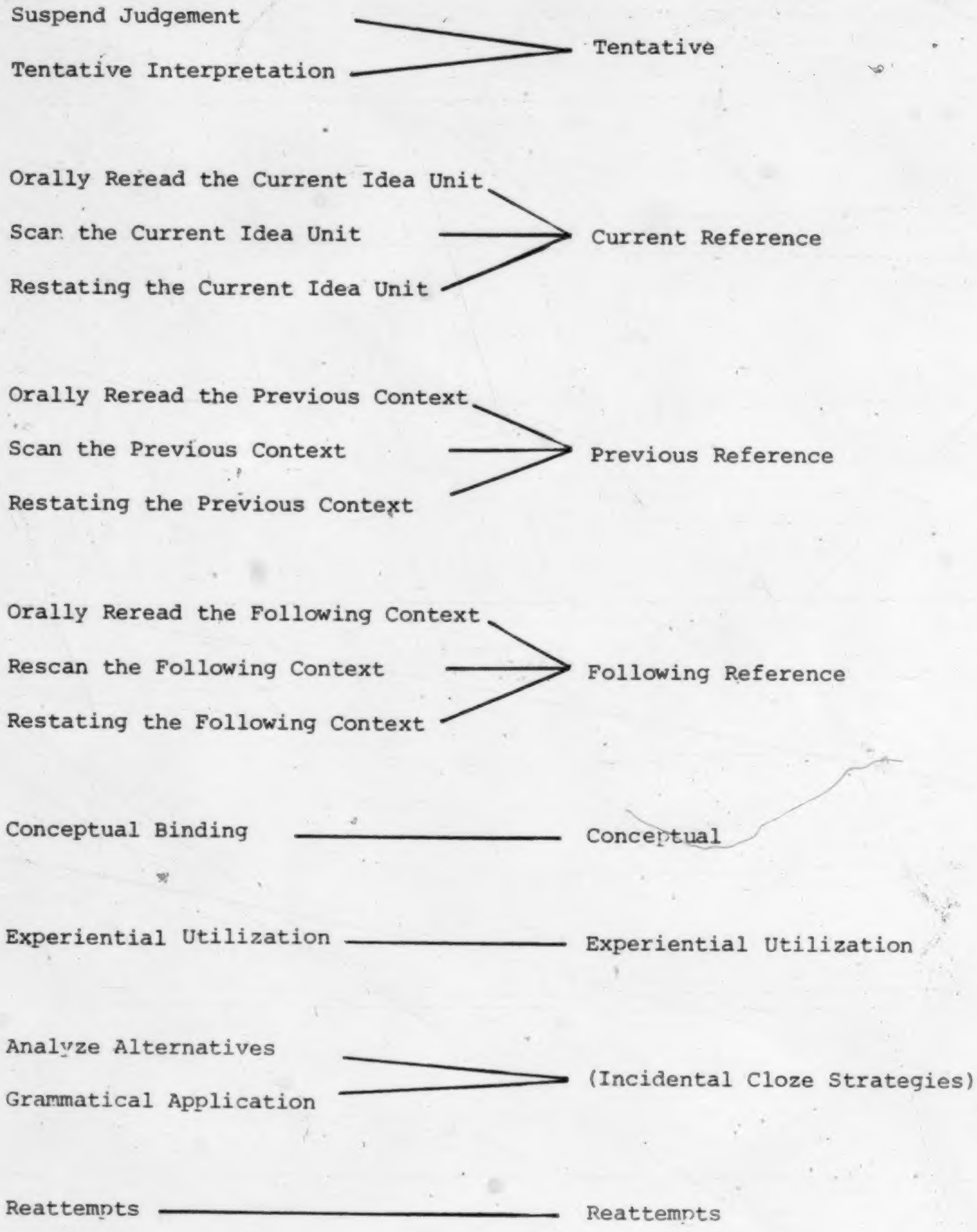
Suspend Judgement
Tentative Interpretation
Tentative
Orally Reread the Current Idea Unit
Scan the Current Idea Unit
Restating the Current Idea Unit
Current Reference
Orally Reread the Previous Context
Scan the Previous Context
Restating the Previous Context
Previous Reference
Orally Reread the Following Context
Rescan the Following Context
Restating the Following Context
Following Reference
Conceptual Binding
Conceptual
Experiential Utilization
Experiential Utilization
Analyze Alternatives
Grammatical Application
(Incidental Cloze Strategies)
Reattempts
Reattempts

Figure 3

A Summary of Expanded Categories

context four times. Since these specific strategies were combined to form the expanded category, previous reference, these scores were also combined, and the incidence of previous reference was 13.

Tables 25 and 26 present the incidence of strategy use utilizing the expanded categories for the high and low recall participants.

Related and Expanded Categories: Results and Discussion

In general, the analysis using the expanded categorical framework revealed considerable consistency with the previous analysis. Similar trends, particularly in the use of current reference and previous reference, were evident in the C2 condition. Again the group did not differ in their use of this strategy in the C4 condition. However, both groups and particularly the low recall participants increased their use of these strategies in the cloze condition.

Tests using the Wilcoxin matched pairs signed-ranks test revealed that, while this increase only approached significance for the high recall participants, the increase for the low recall participants proved to be significantly higher than similar strategy use in the C2 condition (Current Reference $W = 0$ $p = .0313$; Previous Reference $W = 0$ $p = .0313$). This would suggest that the C4 reading situation may have encouraged the low recall group to act more like their successful counterparts in the C2 condition. With respect to experiential strategy use, in the C2 condition the two groups did not differ appreciably ($U = 9.0$ $p > .05$). However, in the C4 condition, the high recall participants tended to utilize this strategy significantly more often ($U = 3.5$ $p > .01 < .05$). This suggests that these participants

Table 25

Summary of Expanded Categories: High Recall Participants

	Tentative	Current Reference	Previous Reference	Following Reference	Conceptual Binding	Experiential Utilization	Reattempts	(Incidental Cloze Strategies)
Par 16								
P2C2	15	14	12	9	8	10	6	1
P4C4	81	37	13	4	22	8	38	16
Par 1								
P2C2	2	1	1	0	6	2	0	0
P4C4	28	36	7	2	24	14	2	13
Par 20								
P4C2	12	12	8	2	11	8	4	1
P2C4	14	11	9	2	9	2	3	5
Par 2								
P1C2	5	3	9	5	4	0	2	1
P3C4	72	14	51	3	30	7	33	19
Par 4								
P3C2	3	13	11	1	1	2	0	0
P1C4	28	16	9	5	8	5	0	14

Table 26

Summary of Expanded Categories: Low Recall Participants

	Tentative	Current Reference	Previous Reference	Following Reference	Conceptual Binding	Experiential Utilization	Reattempts	(Incidental Cloze Strategies)
Par 8								
P4C2	8	2	4	8	1	2	0	4
P2C4	33	33	18	6	13	4	3	19
Par 5								
P1C2	8	1	3	1	0	3	1	0
P3C4	34	35	18	3	13	3	22	19
Par 7								
P3C2	6	8	2	5	0	3	0	0
P1C4	15	22	6	5	2	2	3	29
Par 10								
P3C2	1	2	2	0	0	0	0	1
P1C4	41	59	8	3	3	3	24	31
Par 21								
P2C2	0	0	0	0	0	0	0	0
P4C4	2	0	1	1	0	0	0	0

may have been able to recognize the need for a greater use of prior knowledge and experience in the cloze condition. For the high recall group this may also indicate more flexible strategy use. While the low recall participants would typically increase the use of current and previous reference, the high recall group increased the use of these strategies but also, relative to their low recall counterparts, increased the use of the experiential strategy (see Tables 25, 26 and 27).

Referring to Table 28, the two most reliable predictors of recall performance in both the C2 and C4 conditions are conceptual binding and experiential utilization. Although the use of current, previous and following reference all showed definite trends in the C2 condition, this appeared to be less the case in the C4 condition. However, it is interesting to note that in the analysis of specific strategies (see Table 24) this trend for the C4 condition also appeared.

In summary, the collapsing of the data appears to have retained the relevance of the findings that were revealed in the initial analysis, particularly with reference to group comparisons. Certainly it can be said that some of the precision may be lost in the interpretation but it is felt that the expanded framework provides a more workable paradigm. Therefore, further analysis was based on these expanded categories.

The following section will provide a rationale and procedure for analysing patterns of remedial action.

Table 27

Mann Whitney (U) Results: High Recall and Low Recall Group Differences in Use of Remedial Action (Expanded Categories)

	C2	C4
Conceptual Binding	U = .5**	U = 4.0*
Experiential Utilization	U = 9.0	U = 3.5*
Current Reference	U = 6.0	U = 11.0
Previous Reference	U = 4.0*	U = 9.0
Following Reference	U = 15.0	U = 14.5
Tentative	U = 8.0	U = 10.0
(Cloze Strategies)	--	U = 6.0

* $p > .01 \leq .05$

** $p \leq .01$

Table 28

Spearman Rank Correlation Coefficients (rs) of Recall Performance with Expanded Categories: Total Group (N = 21)

	C2 Recall Performance	C4 Recall Performance
Conceptual Binding	.418*	.515**
Experiential Utilization	.371*	.404*
Current Reference	.606**	.366
Previous Reference	.308*	.258
Following Reference	.407*	-.329
Tentative	.147	.280

* p > .01 ⩽ .05
** p ⩽ .01

Emergent Patterns of Remedial Action: Framework for Analysis

Implicit in a holistic transactional view of reading comprehension and text interpretation is the notion of encounter. Essentially the interpretation of a text is evoked through the encounter between the reader and the text. This encounter is regulated by the reader and involves the utilization of cognitive activity of which part is strategic intervention. This strategic intervention can be generally of two forms, text dependent and reader dependent orientations. A text dependent orientation involves a literal adherence to the text. Included in this orientation is the application of remedial actions such as referring to the current, previous and following reference, and in the C4 condition, the additional use of grammatical knowledge and analysis of alternatives.

A reader dependent orientation tends to invite more of an elaborative stance, in which the reader responds to the text through the use of personal experiences, knowledge of logical relationships and criticisms. Conceptual and experiential remediation strategies are considered part of this orientation.

However, if one assumes a transactional position, neither of these orientations in themselves may be sufficient to account for the successful resolution of the comprehension difficulty. Essentially, a third orientation reflecting a situation in which both the reader and text contribute to the successful encounter is required. In this orientation the reader would utilize a network of text dependent and reader dependent strategies in an attempt to resolve the comprehension difficulty. The strategy of tenativeness would be applicable to all three orientations.

Utilizing this orientation, the following categories were established to assess both the qualitative network of remedial action and the relationship between remedial activity and the successful resolution of the comprehension obstacle:

Text Dependent

Text Dependent Interactional

Reader Dependent

Reader Dependent Interactional

Multi-interactional (Text Dependent, Reader Dependent).

Table 29 and Figure 4 present a summary of these patterns of remedial action. A brief description of each of these follows.

Text Dependent

The use of a single text dependent strategy was by far the most predominantly utilized by the least successful participants. In these cases the participants relied on only one text dependent strategy in an attempt to resolve the comprehension difficulty. For example, some of these consisted of single lookbacks:

4, P1C4

If I look up here I might find something for a word that fits in there.

20, P2C4

I have to go back.

or the rereading of the previous context:

4, P3C2

. . . trouble comprehending it. I'd better look back.

Table 29

Summary of Emergent Patterns of Remedial Action

Text Dependent:	Use of one of the following categories of remedial action Current Reference Previous Reference Following Reference (Incidental Cloze Strategies) Tentative
Text Dependent Interactional:	Use of two or more of the following categories of remedial action Current Reference Previous Reference Following Reference (Incidental Cloze Strategies) Tentative
Reader Dependent:	Use of one of the following categories of remedial action Conceptual Binding Experiential Utilization
Reader Dependent Interactional:	Use of two or more of the following categories of remedial action Conceptual Binding Experiential Utilization Tentative
Multi-Interactional:	Use of two or more categories of remedial action, of which at least one is Text Dependent Current Reference Previous Reference Following Reference (Incidental Cloze Strategies) and of which at least one is Reader Dependent Conceptual Binding Experiential Utilization (Tentativeness could also contribute to the Multi-Interactional pattern if at least two strategies are included in the pattern, one Text Dependent, and one Reader Dependent.)

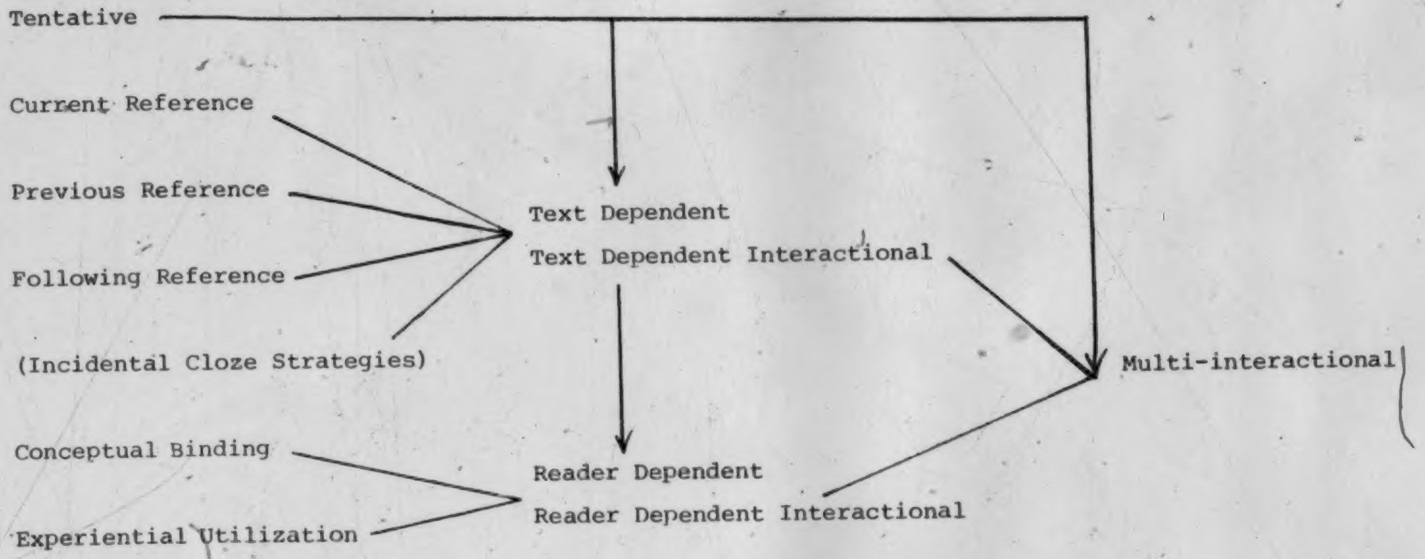
Tentative
Current Reference
Previous Reference
Following Reference
(Incidental Cloze Strategies)
Conceptual Binding
Experiential Utilization
Text Dependent
Text Dependent Interactional
Reader Dependent
Reader Dependent Interactional
Multi-interactional

Figure 4

Diagrammatic Representation of Emergent Patterns of Remedial Action

Text Dependent Interactional

Text dependent interactional procedures consist of the application of two or more text dependent strategies. The following is an example of a text dependent interactional pattern:

> 6, P3C2
>
> There's no error variance at all systematic variance, systematic variance . . . gonna have to look back here, to the second page, perhaps the most general was to classify variance is systematic due to some . . .

In this case the participant reread the current idea unit, then referred to the previous context and reread the previous context.

In another situation the participant is both tentative and refers to the following part of the text:

> 4, P1C4
>
> The primary ideational functions of language can be recognized, these are the directive, interpretive, okay, this word here, I guess I'm gonna have to look forward to because, I gotta see, it's in divisions.

This was a very common pattern particularly in the C4 condition.

Tentativeness was only included in this pattern if the participant chose to make a tenative interpretation, or leave the difficulty for the time being and returned at a later point.

Another example consists of the participant rereading the text and then retelling the significant aspects:

> 4, P3C2
>
> Everything in the world . . . dictionary . . . This great big book with everything in it that has always happened okay, all one needs to do is look . . . occurrences. So there's no way that a chance occurrence can change that everything is accounted for . . . error variance. So error variance is anything that occurs that happens by chance, we have no control over it and we cannot do anything to change it.

Whereas the text dependent patterns consisted of referring to the previous, following and current text, grammatical application and rapid analysis of alternatives, the reader dependent patterns primarily consisted of experiential utilization and conceptual binding. Tentativeness was also evident and was included as a remedial strategy.

Reader Dependent

The single reader dependent strategy emerged more as an isolated strategy. The following is an example of conceptual binding:

> 13, P3C4
>
> If these children are taught inexpertly the other ones must be taught expertly.

The incidence of single reader dependent strategies rarely emerged. This may suggest that if readers use experiential and conceptual strategies, these strategies are used in conjunction with other strategies, and most likely will consist of text dependent strategies and tentativeness.

Reader Dependent Interactional

Reader dependent interactional patterns, although far less frequent, did occur at times. In this pattern the two or more of the reader dependent strategies, experiential, conceptual and tentativeness, are integrated. This is evident in the following example in which the reader formed a tentative interpretation and conceptually related the interpretation to the text:

20, P2C4

> He's . . . sucking action . . . more differentiated scheme of moving his fingers, or from seeing, moving seeing, or from moving his fingers or from seeing and observing an object separately to grasping. Alright to move from the reflex sucking action to the more differentiated scheme of moving his fingers, or from seeing an object separately, from seeing and taking or grasping because taking, I'll use the word taking because differentiated scheme of moving his fingers is one, or from seeing and taking an object separately that's two. Okay, so he has to see and take in an object separately that's two different things, he sees and he takes. Okay, there's one he was just moving his fingers, and then after that he sees and he grasps or takes an object. Okay to grasping an object he can see. Okay let's see if it does make sense. Seems to me it does make sense.

or tentatively related an experience to the text:

8, P3C2

> That's telling me how many people are retarded or average, I guess.

Multi-Interactional (Text Dependent, Reader Dependent)

In the use of multi interactional remedial action, numerous combinations of text and reader dependent strategies are possible. The patterns tend to range from the integration of multiples of reader and text dependent strategies to the more simple combination of one reader and one text dependent strategy. The following provides an illustration of a multi interactional pattern:

20, P4C2

> Oh I think I'm I'm getting to understand that sentence here okay I read it many times and then I tied it in I tied it in with the second sentence where it says you can combine the rules to a great variety of other rules and how does can you do this. Well he can do this by responding to responding his applying the rule okay to various forms of stimulation from his environment okay I mean the environment provides him with various forms of stimulation or stimuli and he can apply those rules to what he recognize from the stimulation. Okay the environment provides him a sentence book passage the sentence something like that and

> he can recognize maybe the the rule because you know the environment has provided him with with that sort of the environment being the book in this case and he can apply it's a deduction that's a reverse deducation okay it's a reverse process if he is asked to write a passage of a book or a text or paper an essay or something like that you take that rule and he applies it again the ideas that you have are provided by the environment if he is asked to write about the birds and the bees for example the birds and bees will provide the environment but he will by a set of rules apply them to the birds and bees environment to to write something that's decent okay make that clear? Anyway I'll read more and make sure that what I just said was correct, yeah. Okay.

In this situation the participant reread the current idea unit, retold aspects of the text, conceptually related the text, provides a personal experiences, forms a tentative interpretation and then refers to the following text in an attempt to confirm.

In the following example, in an attempt to resolve the comprehension difficulty, the reader first read over the idea unit, made a tentative interpretation, then conceptually related the interpretation to the previous context, and also refers to the previous context to support and confirm the interpretation.

> 1, P4C4
>
> The adult does ______ what middle means, probably does not. If the adult does not know what middle means he may learn by acquiring a _____ linking another concept he already knows such as in between. He may learn it by acquiring a ______. I'm going to put chain there. Up above they say similar chains can be formed with other objects so the word middle can also be linked with the word in between and if the adult already knows the word in between he can link the word in between with the word middle so that would more likely be a chain linking. That seems to be the idea I'm getting out of the first paragraph. I think this makes sense.

This emerging framework was utilized for two purposes. First to compare the patterns of remedial actions of the most and least successful participants and second to examine the extent to which these actions contributed to the successful or unsuccessful resolution of comprehension difficulties.

Patterns of Remedial Action: Results and Discussion

Although the two groups, high and low recall participants, did not differ appreciably in the individual incidence of strategy use and the number of attempts to resolve comprehension failure, the groups did differ considerably in their use of patterns of remedial action (see Tables 30, 31 and 32). The high recall participants tended to utilize significantly more multi-interactional patterns than the low recall participants in both the C2 and C4 conditions. However, in the use of text dependent strategies this trend for the two groups was reversed. In this case, compared to the high recall participants, the low recall participants utilized significantly more text dependent patterns in both the C2 and C4 conditions. Differences between the groups in the use of text dependent interactional patterns was not significant. This was similarly evident with respect to utilization of reader dependent interactional and reader dependent patterns of action. However, the total incidence of pattern usage in the latter two situations was too small to warrant statistical analysis.

It is important to note here that this section only deals with group differences in patterns of remedial action. A further crucial question is what was the success rate associated with the various patterns. Before this question could be dealt with it was first necessary to clarify the concept of successful and unsuccessful remedial action.

Table 30

Success and Failure for Patterns of Strategy Use for High Recall Participants

	+	-	uc	Total Multi Interactional	+	-	uc	Total Reader Dependent Interactional	+	-	uc	Total Reader Dependent	+	-	uc	Total Text Dependent Interactional	+	-	uc	Total Text Dependent	Total Success +	Total Failure -	Total Uncertain uc	Total Action	Total No Action	Total Difficulties Recognized
Par 16																										
P2C2	10	1	2	13									0	5	1	6	1	1	1	3	11	7	4	22	0	22
P4C4	23	6	2	31									10	8	1	19	2	0	0	2	35	14	3	52	2	54
Par 1																										
P2C2	0	1	1	2									0	0	0	0	0	0	0	0	0	1	1	2	0	2
P4C4	12	11	0	23	1	0	0	1	1	0	0	1	2	8	0	10	1	0	1	2	17	19	1	37	1	38
Par 20																										
P4C2	8	0	0	8									0	2	1	3	0	1	2	3	8	3	3	14	0	14
P2C4	4	3	0	7	1	0	0	1	1	0	0	1	3	3	0	6	1	3	1	5	10	9	1	20	0	21
Par 2																										
P1C2	2	0	1	3									1	0	1	2	0	2	0	2	3	2	2	7	0	7
P3C4	20	9	4	33	1	0	0	1	1	0	0	1	12	7	1	20	2	3	0	5	36	19	5	60	0	60
Par 4																										
P3C2	4	1	1	6									0	0	0	0	0	0	1	1	4	1	2	7	0	7
P1C4	3	5	0	8									7	9	1	17	1	4	0	5	11	18	1	30	2	32

+ Success
- Failure
uc Uncertain

Table 31

Success and Failure of Patterns of Strategy Use for Low Recall Participants

	+	-	uc	Total Multi Interactional	+	-	uc	Total Reader Dependent Interactional	+	-	uc	Total Reader Dependent	+	-	uc	Total Text Dependent Interactional	+	-	uc	Total Text Dependent	+ Total Success	- Total Failure	uc Total Uncertain	Total Action	Total No Action	Total Difficulties Recognized
Par 8																										
P4C2	2	1	0	3									1	0	0	1	0	2	1	3	3	3	1	7	0	7
P2C4	5	12	0	17					1	1	0	2	2	4	0	6	5	15	1	21	13	32	1	46	0	46
Par 5																										
P1C2	0	0	1	1					0	1	0	1	2	0	1	3	2	3	1	6	4	5	3	11	1	12
P3C4	7	6	0	13					1	0	0	1	6	12	0	18	10	12	1	23	24	30	1	55	3	58
Par 7																										
P3C2	1	0	1	2									2	0	0	2	1	4	1	6	4	4	2	9	1	10
P1C4	2	2	1	5									4	10	0	14	5	6	1	12	11	18	2	31	2	33
Par 10																										
P3C2	0	0	1	1									0	1	0	1	0	1	3	4	0	2	4	6	0	6
P1C4	3	2	0	5									8	24	0	32	5	9	0	14	16	35	0	51	1	52
Par 21																										
P2C2	0	0	0	0									0	0	0	0	0	2	0	2	0	2	0	2	2	14
P4C4	0	0	0	0									0	0	0	0	3	4	5	12	3	4	5	12	11	23

+ Success
- Failure
uc Uncertain

Table 32

Mann Whitney (U) Results: High and Low Recall Group Comparisons of Patterns of Strategy Use and Proportion of Success

		Proportion Total Use High and Low Recall Participants		Percentage Success of Pattern Use High and Low Recall Participants	
Multi Interactional	C2	U = .5	p > .004 < .008	U = 4.0	p = .048
	C4	U = 2.0	p = .016	U = 2.5	p > .016 < .028
Text Dependent Interactional	C2	U = 10.0	p = .345	U = 8.5	p < .274
	C4	U = 11.0	p = .421	U = 4.0	p = .048
Text Dependent	C2	U = 0	p = .004	U = 14.0	p > .579
	C4	U = 1.0	p = .008	U = 12.0	p = .500
Total No Action	C2	U = 5.0	p = .075		
	C4	U = 8.5	p > .210 < .274		
Total Action	C2	U = 10.0	p = .345	U = 4.0	p = .048
	C4	U = 11.0	p = .421	U = 1.5	p > .008 < .016

The Concept of Successful and Unsuccessful Patterns of Remedial Action

Monitoring success and failure was determined by cloze response, cognitive match statements, appropriate interpretation and confirmation statements. Since the primary purpose of the cloze tasks was to understand and remember the information, as opposed to exact reconstruction, appropriate synonyms were accepted. Consequently, if an individual monitored a response and inserted a term which approximated the original term and made sense, the monitoring was viewed as successful. If the term was inappropriate or no term was inserted, the monitoring was viewed as unsuccessful.

Cognitive match statements, indicating agreement or a match with the text, acted as a signal to indicate that the comprehension failure had been resolved. For example:

5, P3C4
Okay, now that seems pretty straight forward.

If the statement indicated an element of tentativeness a neutral probe was used to confirm the adequacy of the interpretation.

In the case of confirmatory statements, two types of responses indicated that a difficulty had been resolved. These consisted of confirming a nonimmediate interpretation, in which an interpretation was made and the reader after having moved on decides that the interpretation was appropriate, and confirming an immediate prior interpretation in which an interpretation was made and the reader within the next idea unit decides the interpretation was appropriate.

Confirming a nonimmediate prior interpretation is illustrated by the following examples:

6, P2C2

I'm just trying to connect them again I'm tacking all these little tidbits right then I'm gonna put them together . . . capable . . . because he has these concrete operations now, because he has these cognitive achievements up to this point let's say of classification and the reversability of the thought that actions can be retraced and changed in the original situation restored, that doesn't actually have to do with thought though, oh yes it says idea in thought steps can be traced all right so in that way he could reason. I see the principle of it.

20, P4C2

Well to my, not my answer but the verification that what I said here was correct.

and a situation in which an immediate prior interpretation was confirmed is illustrated below:

20, P4C2

Ah, there my answer I think, yeah, I was right, okay my answer to my to my hypothesis where I said I think he's bringing the bad or negative side of learning in order to compare it to the positive aspect of learning, and it said in the in the last sentence he says to counteract this loss of or loss of discrimination learning which is forgetting the loss of discrimination learning is forgetting to counteract that he says or to stop it or to inhibit that he explained that exactly what I was looking for earlier in that part in that sentence the word connection especially if the discrimination aspects of the chain have not been internalized. Okay, well I didn't know what he meant by internalized but now I understand that I understand the process of where he's trying to explain that okay.

Unsuccessful attempts or failures were indicated by a reiteration if the initial source of difficulty, a general meta statement stating such, a misinterpretation and in the cloze conditions an inappropriate insertion. Incorrect tentative interpretations and suspended judgements were also categorized as unsuccessful attempts. Even though in many instances, the participant would state the interpretation, at times the success or failure of a response was not clear and in this case the item was labeled as uncertain. This was most applicable for

Type IV (relational) difficulties and Type V(mnemonic) difficulties and least applicable for cloze responses.

The following section will provide an overview of the results pertaining to successful and unsuccessful remedial action.

Successful and Unsuccessful Patterns of Remedial Action: Results and Discussion

Referring to Tables 30, 31 and 32, the two groups, high recall and low recall participants, did not differ significantly with respect to not taking any remedial action when they should have (no action). In this case the participant recognized the difficulty but chose not to initiate any remedial action. The difficulty was either just omitted or the resolving of the difficulty was not considered important to the participant's understanding of the text. The no action column in Tables 30 and 31 is comprised of the nonapplicable and omission responses from Table 20.

The high recall participants tended to utilize significantly more Multi-Interactional patterns than the low recall participants in both the C2 and C4 conditions (see Tables 30, 31 and 32). Associated with the use of the multi-interactional patterns was a significantly higher success rate. Essentially this pattern enabled the high recall group to successfully resolve significantly more comprehension difficulties.

Although the groups did not differ significantly in their total use of Text Dependent Interactional patterns, the high recall group experienced greater success utilizing this pattern. This was most evident in the C4 condition (see Tables 32, 33 and 34).

Table 33

Patterns of Strategy Use for Percentage of Total Determined Success

High Recall Participants							Low Recall Participants						
	Multi-Interactional	Reader Dependent Interactional	Reader Dependent	Text Dependent Interactional	Text Dependent	Total Percentage Success		Multi-Interactional	Reader Dependent Interactional	Reader Dependent	Text Dependent Interactional	Text Dependent	Total Percentage Success
Par 16							Par 8						
P2C2	56	0	0	0	5	61	P4C2	33	0	0	17	0	50
P4C4	47	0	0	20	4	71	P2C4	11	0	2	4	11	29
Par 1							Par 5						
P2C2	0	0	0	0	0	0	P1C2	0	0	0	22	22	44
P4C4	33	3	3	5	3	47	P3C4	12	0	2	10	17	41
Par 20							Par 7						
P4C2	73	0	0	0	0	73	P3C2	13	0	0	25	13	51
P2C4	21	5	5	16	5	53	P1C4	7	0	0	13	17	37
Par 2							Par 10						
P1C2	40	0	0	20	0	60	P3C2	0	0	0	0	0	0
P3C4	36	2	2	22	4	66	P1C4	6	0	0	16	10	31
Par 4							Par 21						
P3C2	80	0	0	0	0	80	P2C2	0	0	0	0	0	0
P1C4	10	0	0	24	3	38	P4C4	0	0	0	0	43	43

Table 34

Percentage Distribution of Successful Patterns of Remedial Action

High Recall Participants						Low Recall Participants					
	Multi Interactional	Reader Dependent Interactional	Reader Dependent	Text Dependent Interactional	Text Dependent		Multi Interactional	Reader Dependent Interactional	Reader Dependent	Text Dependent Interactional	Text Dependent
Par 16						Par 8					
P2C2	92	0	0	0	8	P4C2	67	0	0	34	0
P4C4	65	0	0	29	6	P2C4	39	0	7	14	39
Par 1						Par 5					
P2C2	0	0	0	0	0	P1C2	0	0	0	50	50
P4C4	71	7	7	11	7	P3C4	29	0	5	24	42
Par 20						Par 7					
P4C2	100	0	0	0	0	P3C2	25	0	0	49	25
P2C4	40	10	10	30	10	P1C4	17	0	0	37	46
Par 2						Par 10					
P1C2	67	0	0	33	0	P3C2	0	0	0	0	0
P3C4	55	3	3	33	6	P1C4	19	0	0	48	32
Par 4						Par 21					
P3C2	100	0	0	0	0	P2C2	0	0	0	0	0
P1C4	27	0	0	64	8	P4C4	0	0	0	0	100

Compared to the high recall participants, the low recall participants tended to utilize significantly more Text Dependent patterns. However, this did not appear to facilitate their success rate. The data reveal that success using this pattern did not differ significantly for these two groups. It would appear that the almost exclusive use of Text Dependent patterns of remedial action to resolve comprehension difficulties tends to contribute to limited success in resolving comprehension difficulties and recall performance.

While success appeared to be primarily influenced by the use of the Multi-Interactional pattern for the high group, success for the low group tended to be determined by the use of Text Dependent Interactional and Text Dependent patterns (see Tables 33 and 34). For example, referring to Table 33, participant 16 in P4C4 was able to successfully resolve 71% of the difficulties. Of this 71%, 47% of the remedial action initiated was Multi-Interactional, 20% was Text Dependent Interactional and 4% was Text Dependent. Referring to Table 34, 65% of the monitoring success for this same participant was accounted for through the use of Multi-Interactional patterns, 29% of the success was accounted for by Text Dependent Interactional patterns and 6% of the success was accounted for by the Text Dependent patterns.

On the other hand, participant 10 in the P1C4 reading situation was able to successfully resolve 32% of the difficulties. Of this 32%, 6% of the remedial action initiated was Multi-Interactional, 16% was Text Dependent Interactional and 10% was Text Dependent.

Referring again to Table 34, 19% of the monitoring success for this participant was accounted for through the use of Multi-Interactional patterns, 49% was accounted for by Text Dependent Interactional patterns, and 32% was accounted for through the use of Text Dependent patterns.

Although the primary focus of this investigation was on the central aspects of the comprehension monitoring process, the researcher also remained open and sensitive to data which may yield insights into the correlates of this process. These correlates, identified as interpretation of the criterial task, macroprocedures, task orientation and motivation are an integral part of monitoring but not a central component of this process. The purpose of the following section is to present and discuss the findings related to these correlates of the monitoring process.

Correlates of the Monitoring Process

Interpretation of the Criterial Task

Although all participants were given the same criterial task instructions, the data revealed a wide range of interpretations related to understanding and remembering. In general understanding seemed to imply some form of explanation or elaboration whereas remembering seemed to imply recall.

Some excerpts concerning the notion of understanding are given below:

> 16, P2C2
> You can see it.
>
> 14, P4C2
> Can understand because I can explain it.

2, P3C4

I can understand it because I can put it in my own words and explain it.

20, P3C4

By understanding little bits by little bits and making a progressive step to finally come to the top explanation it takes a long time, but there are series of small steps.

When you understand something you can explain it that way and you can compare it with something you already know then you understand.

7, P3C2

I can relate it to personal experience.

7, P1C4

I felt I understood it.

8, P4C2

It doesn't make much sense. When I was reading it I was stumbling over a lot of it and after I read a passage I would try to think about it and I would generalize it but at the same time it was pretty vague.

I didn't really understand them, I found that I was kinda guessing a lot of the time. In the other ones I could find some verification for my guesses, but in this one, they were there but you had to really look for them.

8, P2C4

If I don't understand it, if I can't expand on my notes then I know that I have to go back and read the paper again.

6, P4C4

I understand problem solving because I use it all the time, it relates to everything, you take your rules and you try to use them and if they don't work, you learn new ones to accommodate and all that kinda stuff. So problem solving is easy.

Examples of participant interpretations of remembering are as follows:

13, P1C4

I can recall something about it.

2, P3C4

> Can remember because could remember without looking at the page.

7, P3C2

> If I really can't remember a lot of what went earlier, well I know its gonna take a lot of repetitions.

6, P2C2

> I didn't take in very much of it.

8, P4C2

> I don't remember anything, because it's hard to recall throughout the passage.

The interrelatedness of these concepts was additionally reflected in certain comments made by the participants. For example:

13, P3C2

> I can recall something about it, but can't say anything about it.

7, P3C2

> I think if you don't understand something, I think a lot of people say okay I'll forget about it, it's not even worth thinking about, if you do understand I think you'll remember it a lot more.

6, P4C4

> I'd remember that because I disagree. I disagree with it or it's not settled kind of.

13. P1C4

> Function of language is not clear one, maybe if I read something about it, it might be easier. Feel don't know that much, and still don't. Didn't get anything out of it. Don't have a clue. Can't remember a sentence, a word or anything. Just took it in piece by piece. Not as a whole. Right now I couldn't tell you anything about it.

Overall, the previous examples lend support to the view that for most participants criterial task performance is perceived quite generally and intuitively.

Examining mean recall performance (text entailed + text specific responses) for all 21 participants in the first reading situation (12.76), second reading situation (13.66), third reading situation (16.87) and fourth reading situation (18.33) a trend towards a learning or order effect as participants progressed through the sessions appeared evident. However, the F ratio of .7463, derived from the one-way analysis of variance, Treatments x Recall, was not significant (p > .05). This trend was far more apparent for the high recall participants (see Table 35). Possibly task requirements for the group became clearer over treatments, and this was accompanied by more appropriate remedial action, and recall success.

Macroprocedures

Participants utilized a variety of procedures in an attempt to resolve their lack of understanding or recall of the essential information. These procedures were usually implemented in response to the experience of not knowing or remembering (Type IV or V difficulties). Remembering was for most participants a more clear criterial task purpose. These actions were in most cases implemented following the initial cloze and non-cloze verbalization. Macroprocedure usage led to a distinct dichotomization of the task. Individuals would complete the verbalization and the cloze component of the task, and then implement these more general remedial actions. These actions consisted of general text review, rereading key terms, rehearsal, underlining and note taking (see Tables 36 and 37). Although one or more of these general procedures was in evidence for most of the participants, both the quality and number of procedures implemented varied considerably. The high recall group tended consistently to utilize more different procedures than the low recall group. These differences were

Table 35

Recall Performance (Text Entailed + Text Specific) x Order of Reading Situation: High Recall and Low Recall Participants

	First RS	Second RS	Third RS	Fourth RS
Par 16	29	19	33	34
Par 1	25	13	37	31
Par 20	22	21	25	22
Par 2	18	19	18	29
Par 4	8	10	31	25
Par 8	18	14	10	9
Par 5	9	7	16	14
Par 7	14	7	11	13
Par 10	8	6	10	7
Par 21	2	2	3	4

RS = Reading Situation

Table 36

Summary of Macroprocedures: High Recall Participants

	Review Text *	Reread Key Terms *	Rehearse *	Underline *	High Level Idea Units	Intermediate Level Idea Units	Low Level Idea Units	Notes *	High Level Idea Units	Intermediate Level Idea Units	Low Level Idea Units	Underline Notes*	Rehearse Notes *	Review Notes *	Total Use of Macroprocedures
Par 16															
P1C1	1			✓				✓	✓	✓	✓		✓		4
P2C2	3	✓	✓	✓	✓	✓	✓						✓		5
P3C3	1														1
P4C4	1	✓	✓												3
Par 1															
P1C1								✓	✓	✓	✓		✓	✓	3
P2C2	1	✓	✓												3
P3C3								✓	✓	✓	✓		✓	✓	3
P4C4	1	✓	✓												3
Par 20															
P3C1								✓	✓	✓		✓	✓	✓	4
P4C2	1	✓		✓				✓	✓	✓		✓	✓	✓	7
P1C3								✓	✓	✓		✓	✓	✓	4
P2C4	1	✓		✓				✓	✓	✓		✓	✓	✓	8
Par 2															
P2C1								✓	✓	✓	✓				1
P1C2	1		✓												2
P4C3								✓	✓	✓	✓			✓	2
P3C4	1		✓					✓	✓	✓	✓	✓	✓	✓	6
Par 4															
P4C1								✓	✓	✓	✓		✓	✓	3
P3C2	1		✓					✓	✓				✓	✓	5
P2C3								✓	✓	✓	✓				2
P1C4	1		✓												2

* Macroprocedure

Table 37

Summary of Macroprocedures: Low Recall Participants

	Review Text *	Reread Key Terms *	Rehearse *	Underline *	High Level Idea Units	Intermediate Level Idea Units	Low Level Idea Units	Notes *	High Level Idea Units	Intermediate Level Idea Units	Low Level Idea Units	Underline Notes*	Rehearse Notes *	Review Notes *	Total Use of Macroprocedures
Par 8															
P3C1								✓	✓					✓	2
P4C2	1														1
P1C3								✓	✓						1
P2C4	1			✓	✓										1
Par 5															
P2C1								✓	✓	✓					1
P1C2	1		✓	✓	✓										2
P4C3								✓	✓				✓		2
P3C4	1														1
Par 7															
P4C1								✓	✓	✓	✓	✓			2
P3C2	1		✓					✓	✓	✓	✓	✓		✓	4
P2C3															0
P1C4	1		✓												2
Par 10															
P4C1								✓	✓	✓	✓				1
P3C2	2							✓	✓						2
P2C3															0
P1C4	2		✓					✓	✓					✓	4
Par 21															
P1C1															0
P2C2	1														1
P3C3															0
P4C4	2														1

* Macroprocedure

significant in all conditions (see Table 38).

Furthermore, the quality of the procedures varied across the groups. For instance, rehearsal for the high recall group consisted of recall of major terms, self repetition, paraphrase, self explanation and self questioning, while for the low recall group, rehearsal if utilized consisted primarily of self repetition. Another case in point is the quality of the notes. The notes of the high recall group tended to be more elaboarate and structured than those of their counterparts in the low recall group. In addition to these groups differing in quantity and quality of the procedures used, differences in how the procedures were utilized were also evident. For instance, the notes of the high recall group tended to be rehearsed, reviewed and at times underlined, while note review and rehearsal were only incidentally utilized by the low recall participants. As a research area in itself this warrants further investigation. The macroprocedures utilized by the two groups and within the two groups differed considerably and were highly idiosyncratic. This large variability and idiosyncratic use may partially account for discrepant research findings in the utility of certain study strategies (Brown and Day, 1983). The question of whether individuals utilize a strategy or not may no longer be the significant question, but rather the quality of the strategy, how the strategy is used and in combination with other strategies and for what purpose. These may be the more significant questions that may have to be addressed in future research in this area.

Table 38

Mann Whitney (U) Procedure: Comparison of Macroprocedure Use, High and Low Recall Groups, Across Conditions

Condition 1	U = 3	p = .028
Condition 2	U = 3	p = .028
Condition 3	U = 2.5	p > .016 < .028
Condition 4	U = 3	p = .028

Task Orientation

The approach to the task was generally indicated by verbal and nonverbal responses. Although individuals varied considerably in their approach to the task, two common trends emerged: the need for a more holistic orientation to the task and the need to utilize personal experience.

The need for a more holistic orientation to the task was indicated by the recognition and response to relational difficulties (Type III and IV difficulties) and orientation to the cloze task. For example, the following meta statements suggest the participants are aware of certain relation difficulties or Type III and IV errors:

> 6, P4C4
>
> I wasn't putting it together, just putting individual blanks toether.
>
> 4, P1C4
>
> Check to see if it all fits together. Read it over quickly to see if I have everything established as I want.
>
> 20, P4C2
>
> I understand it very well bit by bit now I wannta see if I understand it as a whole.

This was also evidenced by the individual's pursuit of the gist, or main focus of the text.

> 15, P1C2
>
> Became so concentrated on the individual sentence I forget what the overall topic is about.
>
> 18, P2C2
>
> The more I read it, the more I realize I'm not getting the gist of it. I can understand sentences two consecutive sentences, and how they relate but when I go to a third one or go on to a previous subject there is no continuity of thought. I can't see how it's building up to explain the overall.

These types of difficulties followed by strategic intervention involving tentativeness, rereading, restating, referring to information beyond the specific idea unit in question and conceptual and experiential action would indicate a holistic orientation to the task. On the other hand, a relatively high incidence of ideational difficulties (Type I and II difficulties) and the strong tendency to refer to the present idea unit as a fix-up strategy, could indicate a more successful orientation to the task. These different orientations were most apparent in the C4 condition, particularly in response to Type VI difficulties.

Participants using a holistic stance would readily attempt to move outside the idea unit in question in an attempt to resolve the difficulty. However, the successively oriented participants tended to remain within the idea unit.

In response to the task, again particularly in the C4 orienting condition, these participants tended initially to process the text sentence by sentence, or roughly the idea units specified. Some participants, particularly the most successful participants, seemed to realize that dealing with the task and text in this manner would contribute to comprehension difficulty. For example:

12, P3C4

Can't just read to fill in but try to make sense.

If this was the case, these participants tended to become more tentative and deal with the passage as a whole as opposed to viewing the text as a set of individual blanks that required filling in.

Of critical concern here is not whether the most successful participants utilized a holistic stance while the least successful individuals utilized a successive orientation, but rather that the groups tended to vary in the degree of holistic successive orientation.

The need to utilize personal experience was the second common trend that emerged. Statements reflecting personal experience and the utilization of prior knowledge were primarily initiated by the most successful participants. For example:

> 19, P4C4
>
> Well, we talked about how ah, how if you, once you learned, you know, but it was sort of internalized rather than remembering the actual rules and there was another thing back there that made me think of something I learned in class, about how ah, oh once you learned so many other things on top of another thing then you tend to remember the last things rather than, and they clutter the first thing.
>
> 20, P2C4
>
> I think the key here is the word differentiated scheme. Okay, first of all he can only move his fingers okay and then and then he makes the see initially just grabbing maybe the pencil or something that he's grasping he's not aware of it's a pencil or a soother or something like that. Okay he's grabbing something it's a pure reflexive action. He feels something if by feeling a reflexive feeling then later on he'll be able to differentiate and to see like he sees this object. He sees a pencil he doesn't know it's a pencil yet but he knows there is an object there. It could be a cup here or two it could be two different things I know they are there can't see and he can without thinking about it he can grab this one or he can grab this one but he's not thinking of what he's really reaching and then when we talk about further scheme, differentiate scheme grasping an object that he can see that he can see means he sees the pencil and he will grasp the pencil see so we have like a we have a progression of grasping. It doesn't mean that he's grasping what he sees you see what I mean might see the cup and go like this and reflectively he grabs the pencil but then later on he can grasp something that he is seeing he sees the cup and he reaches the cup.

These responses served to embellish the text, and tended also to be reflected in remedial actions and elaboration statements in the subsequent recalls. These attempts to embelish the text may be related to text familiarity and application of prior knowledge.

Many participants expressed some familiarity with the texts, however this familiarity was only represented in a very general manner. Responses tended to range from

> 4, P3C2
>
> Oh something I've handled before or read something about Piaget and his stages, so hopefully it won't be all new to me . . . yeah, something I've seen before like I've seen these stages before, yeah, general descriptions on how children at different ages interact with people and I read that . . . before, studied that . . . before so hopefully this passage will be more or less familiar to me and I can, won't take me too long.

to

> 10, P1C4
>
> It looks like an extract from a book.

What is of importance here is that all participants expressed some familiarity with the texts but only some participants (particularly the more successful group) chose to utilize this knowledge to embelish the text.

Motivation

Although all participants were volunteers and willingly attended all sessions, variability in perceived task difficulty and text interest was evident. The C4 condition for most participants appeared to be the most difficult. This is aptly demonstrated by the following example:

> 14, P2C4
>
> The most intelligent person can't fit the word in there!

Some participants found the task particularly difficult because the cloze procedure, for them, seemed to detract from understanding and remembering.

14, P2C4

Don't what what it means. I'm just filling in the blanks.

16, P4C4

Stuff in what I can, like a puzzle, like playing headline hunters.

21, P4C4

How can I understand this if I don't know what goes in there.

6, P4C4

There wasn't enough there to put it into what I already know to join it up with, there's just little bits that jump out and it doesn't seem right.

9, P4C4

It's frustrating 'cause you're, you're wasting time on a word right, and it may not even have any importance to the text plus it takes away from your attention, but my primary task is to remember it, is to understand and remember it.

At times the frustration with the task was stated in a more humorous manner:

10, P1C4

Blank child renames the material and by blank action indicates that he is regarding blank material as a symbol for the blank and "So am I."

or participants began to alter the task to fit their own preferred view of the criterial task:

13, P1C4

Omit those because it makes sense without them.

17, P2C4

Can get the gist without filling it all in.

While the C4 condition was perceived as consistently difficult, the responses to the C2 condition reflected greater variability. Some participants found the verbalization helpful:

> 8, P2C4
>
> Discussing it while I was doing it helped me remember.

while other participants found the verbalization procedure a source of interference:

> 12, P3C4
>
> Became so concentrated on the individual sentence I forgot what the overall topic is about.

Similar variability was reflected in critical response to the text, both in terms of content and organization.

In terms of content, some critical responses reflected the reader's understanding of the idea but in terms of his/her own experiences didn't agree. For example:

> 20, P4C2
>
> I'm not quite necessarily agreeing with with the guy who wrote that and okay, the you know, by just saying you're weakening the first chain so why am I weakening the first chain because I'm learning something else I'm learning, I'm weakening what I've learned before. I said to myself why would learning something else if I would weaken what I've learned doesn't seem to make sense because I acquire I do acquire an awful lot of information daily and it doesn't seem to be destroying what I know like I know how to drive my car and that's basically a reflexive thing but it's something that I have learned.

or a critical response related to a misinterpretation:

> 8, P2C4
>
> I don't understand it, I, what's confusing is that if it's scientific and it's formal logic and concrete content should be important shouldn't be discarded in an odd way. It's almost as if he's really going out on a limb. If it's formal logic and scientific, it has to be proven and if there's something concrete, then you shouldn't argue against it.
>
> 6, P2C2
>
> Yeah, well I think, well when if I when I was eight and ten I could express myself I think to a certain degree if somebody asked me why I did this I could give reasoning to it and logical . . . . you know.

With this misinterpretation involving a critical response, no remedial action was initiated.

Other critical responses related to how the text was written. These responses tended to reflect certain demands or expectations readers had about what constitutes a well formed text. This related to the defining of terms:

> 8, P4C2
>
> I guess it's because they don't really define the different processes. To me they're not really defining what the problem solving is like. They pull the concepts from the other aspects and those haven't been defined either and it's just kinda hard if you don't know what one concept is to put it in and make it sense.

the notion of clarity:

> 6, P2C2
>
> Representations what would it be that representations of concrete events, like there must be another way to say that. Isn't that terrible, and that's why it makes me feel silly. I mean obviously they've written this book for the average, I mean it's not that difficult with this book well whatever this passage. Would everybody else have to do that what I'm doing now? Or would they could they just pick it up, I wonder.
>
> 20, P4C2
>
> Now I'm saying to myself why does he make it so hard for me to understand it you know why he sees something very deep and at his own level and he puts it at his own level instead of bringing it up to a level higher for me to understand it. Here I am, there he is or rather there he is there I am whatever, there's a gap in the way he sees things the way I see things, he's the professional, I'm the layman. Okay if he was talking to another professional then the communication would be horizontal, okay if the text is designed for not the professional the layman, layman then I figure that he should bring his description down to maybe a lower level and me I could, we could meet halfway right now I say to myself this is a bit deep maybe I need more information, may'be I'll read more and I'll you know need more information.

clarification through the use of examples:

7, P3C2

Most of the examples even the population intelligence example wasn't written that well. I just don't think it's written well, because I know if you have a good writer, that's why a writer, some writers are so good like Hemmingway or whatever, they give you examples and you though you've never been there, or seen the place or anything to do with it, you just (he can reconstruct that for you) sure, he can make you understand it and he can make you feel like you're there and you know so I think the big thing is the writer and how they come across. It's just like a teacher, some teachers ahm get up in front of a classroom, some professors and they're really good, they can make you understand it just like that and some can get up there and no matter what they do you just can't understand it, you know.

6, P2C2

The application of logical rules and reasoning . . . I want an example of an abstract problem here.

clarification through the use of vocabulary:

7, P1C4

I thought they used a lot of high-tech words or whatever you want to call it to try to confuse you. They really tried to cover things up with big words.

It coulda been written much easier with a lot less words and coulda gotten the exact same ideas across.

Sometimes they're needed, sometimes you need words like that but right there definitely not.

I was trying to wonder why would somebody do that, you know, I mean, I'm trying to figure out what would the author be like, ahm what type of a person he was like, you know see.

quantity of information:

1, P2C2

There's a lot of information there, like you have to do think well, yeah this happens because they're giving it to you you know just maybe a page of information and they move too fast over the material.

Although many participants felt predisposed to critique the passages and the tasks, this in no way tended to detract from their positive orientation to both the texts and tasks. This was primarily evidenced by comments related to interest and personal development.

> 8, P2C4
>
> His ideas and his views, I don't know, I'd have a great interest in reading the article like if I came across it, I'd probably read it, if I had a chance.
>
> The ideas that he brings across are apparently, they're something that you can relate to. You can think about it, an infant, and the way it acts and then you can think about, you know, your brother or your sister and what stage that you're in.
>
> 1, P2C2
>
> I was really interesting today because it's just what we've been doing. I read it last night and I did it in class today. So it all ties together now.
>
> 7, P3C2
>
> I like it because it's developing myself.
>
> 7, P1C4
>
> Well, this seems interesting, right off the bat. These functions of language, I find very interesting because it's a never ending process you learn more and more and more vocabulary and everything.

In summary, these complex correlates of the monitoring process do appear to play a significant role. However, this investigation area as suggested by Wagoner (1983) is only now beginning to develop, and many avenues remain to be explored.

Summary

Monitoring is a process comprised of four interrelated aspects: (1) recognizing a difficulty has occurred, (2) deciding whether or not to initiate some form of remedial action, (3) given a positive decision for step two, then the initiation of further action and (4) deciding whether or not the action was successful and the difficulty was resolved. In this study participants identified a large number of difficulties. These consisted of ideational difficulties (failure to understand a concept or idea unit), relational difficulties (failure to understand how one idea unit related to another, or how the text fits together), mnemonic difficulties (failure to remember concepts and idea units) and cloze difficulties. In response to these sources of difficulty participants utilized a variety of patterns of remedial action. These consisted of Text Dependent, Text Dependent Interactional, Reader Dependent, Reader Dependent Interactional and Multi-Interactional patterns of remedial action. The Multi-Interactional pattern of remedial action was most highly associated with both the successful resolution of the comprehension difficulty and recall performance.

In the following chapter these findings and others related to the monitoring process will be discussed in terms of the research questions which were previously established to guide this investigation.

Chapter VI

CONCLUSIONS AND IMPLICATIONS

Introduction

The primary purpose of this study was to examine the strategies and patterns of strategies utilized by adult readers in an attempt to resolve comprehension difficulties. In addition, an attempt was made to examine the nature of the comprehension difficulties recognized by the readers and the extent to which remedial action contributed to both the successful resolution of the comprehension failure and criterial task performance.

Following a brief overview of the investigation, the major findings and conclusions pertaining to both this purpose and the research questions will be discussed. In addition, some implications for future research and instruction will be presented.

Review of the Study

In this investigation 21 first year college students each participated in four conditions: C1, Reading Recall; C2, Reading Recall Concurrent Verbalization; C3, Reading Cloze Recall; and C4, Reading Cloze Concurrent Verbalization Recall. An attempt was made to conduct all interviews within a collaborative framework. The participants were selected randomly from an initial group of volunteers, and each individual participated in each of these four conditions over a six to seven week period of time. The expository materials were selected and adapted from third and fourth year level college texts. Associated with each of the C2 and C4 sessions was a lengthy observation and practice session.

The primary sources of data consisted of the recall protocols from the C1, C2, C3 and C4 conditions, the verbalizations from the C2 and C4 conditions, the cloze responses from the C3 and C4 conditions, and the responses to the discussion questions reflecting both the participants' understanding of the text and the interpretation of the general and criterial tasks. Demographic information, field notes, and participants' notes, summaries, and underlinings were compiled and used as anecdotal data.

Data analysis consisted of two phases: first, the data were analyzed to delineate the specific categories which may emerge in terms of the nature of the comprehension difficulties, the nature of the remedial actions initiated, and the extent to which the difficulty was resolved, and second, the analysis consisted of examining the relationships which may exist between the emergent and relevant categories. In addition to the analysis of the data using all 21 participants, the data were also examined comparatively.

On the basis of text specific and text entailed recall responses (complete and incomplete t-units), the five highest and five lowest participants were selected and assigned to a high recall and a low recall group. These two groups differed significantly, not only in terms of text entailed and text specific responses in all four conditions, but also differed significantly in terms of text experiential responses in the C1, C2 and C3 conditions, meta statements in the C3 condition and cloze performance in both the C3 and C4 conditions. An incidental measure of final course grade performance, as measured by a series of multiple choice examinations, also revealed that the two groups differed significantly. In this case the lowest grade of the high recall group was higher than the highest grade of the low recall group.

The focus of the analysis was in terms of the major research questions, and the conclusions pertaining to these questions will be presented in the following section.

Major Findings and Conclusions

1. What spontaneous strategies and patterns of strategies are utilized by adult readers to resolve perceived comprehension difficulties?

The adult readers utilized a wide variety of strategies to resolve comprehension difficulties. In the study the following were identified:

- Reader Dependent
    - Conceptual Binding
    - Experiential Utilization
- Text Dependent
    - Orally Reread the Current Idea Unit
    - Orally Reread the Previous Context
    - Orally Reread the Following Context
    - Scan the Current Idea Unit
    - Scan the Previous Context
    - Scan the Following Context

- Restating the Present Idea Unit
- Restating the Following Context
- Restating the Previous Context
- Incidental Cloze Strategies
    - Grammatical Application
    - Analysis of Alternatives

Tentativeness

- Suspend Judgement
- Tentative Interpretation

These strategies were used both separately and in conjunction with each other. If used separately, the strategies were identified as either Text Dependent or Reader Dependent. The following strategies, since they involved a substantial literal adherence to the text, were identified as Text Dependent: analysis of alternatives; grammatical application; orally reread the current idea unit, previous context or following context; scan the current idea unit, or previous or following context; and restate the present idea unit, or previous or following context. The remaining strategies, conceptual binding and experiential utilization involve more of an elaborative stance. In the use of these strategies the readers tended to respond to the text through the use of personal experience and knowledge of logical relationships. The notion of tentativeness was associated with both text and reader dependence. In addition to the readers using these strategies in isolation, many of the strategies were combined and integrated. The integration of two or more Text Dependent strategies (including tentativeness) was viewed as a Text Dependent Interactional pattern, whereas the integration of two or more Reader Dependent strategies (including tentativeness) was viewed as a Reader Dependent Interactional pattern. If the reader integrated both Text Dependent and Reader Dependent strategies, the emergent patterns were viewed as Multi-Interactional. These emergent strategies and patterns of remedial action were utilized by all the participants to a greater or lesser degree in an attempt to resolve the comprehension failures.

1.1 What is the relationship between the nature of strategic application and the successful resolution of the comprehension difficulty?

The high and low recall group did not differ appreciably in both the initiation and non-initiation of remedial action. This would suggest that the initiation or non-initiation of remedial action is not associated with recall performance. Where the two groups did differ significantly was with respect to the nature of remedial action initiated. The clearest difference arose with respect to the use of Multi-Interactional and Text Dependent patterns of action. Compared to the low recall group, the high recall participants utilized significantly more Multi-Interactional patterns. With respect to the incidence of Text Dependent strategy use the trend was reversed. This was a form of remedial action most often used by the low recall group. For the high recall participants the use of the Multi-Interactional pattern resulted in a significantly higher success rate, and for the low recall participants the use of the Text Dependent pattern resulted in an appreciably lower success rate. Consequently, even if the low recall participants utilized the Text Dependent pattern appreciably more often than the high recall participants, the use of this pattern did not appear to contribute to the successful resolution of the comprehension difficulty. It is apparent that the initiation of remedial action may not necessarily result in the successful resolution of the comprehension difficulty. What appears to be more directly related to the successful resolution of the comprehension difficulty is the nature of the action initiated.

1.2 What is the relationship between strategic application and recall performance?

Although a considerable number of strategies were identified, two strategies, conceptual binding and experiential, were consistently related to recall performance. Essentially participants who utilize prior knowledge and seek and attempt to logically and conceptually relate the ideas together, while attempting to resolve the comprehension difficulties, will tend to do better on the criterial task. Orally rereading the current idea unit was also significantly related to recall performance, while restating the current idea unit, the previous context and scanning the previous context was related to recall performance in the C4 condition. However, scanning the following context was negatively related to recall performance in the C4 condition. Perhaps this strategy is associated with tentativeness, in which the participant, after some initial attempt to resolve the difficulty, chose to abandon the difficulty.

In many instances, particularly with respect to the high recall group, these strategies were not used in isolation, but were integrated and used in conjunction with other forms of action. In this study five forms of strategic patterns were identified: Text Dependent, Text Dependent Interactional, Reader Dependent, Reader Dependent Interactional, and Multi-Interactional patterns. Comparing the high and low recall groups, the high recall group utilized significantly more Multi-Interactional patterns than the low recall participants, while the low recall participants tended to utilize significantly more Text Dependent strategies.

It would appear that the use of Multi-Interactional patterns of remedial action contributes to a more indepth form of processing, and consequently higher recall performance. This would be the case if one can assume that Text Dependent strategies, because of the literal adherence to the text, contribute to less indepth processing while Multi-Interactional patterns of action, because of the reader's use of Text Dependent strategies in conjunction with the use of greater amounts of their own semantic networks, will contribute to more indepth processing. What is critical here is not just the isolated use of Text Dependent or Reader Dependent forms of remedial action, but rather the integration of these forms of action into more holistic patterns of remedial action. Essentially to remedy comprehension difficulties the reader cannot just elaborate and draw from their own prior knowledge. This must be done in conjunction with the text. Consequently, it is not just the use of conceptual binding and elaboration that may contribute to the successful resolution of the comprehension failure and criterial task performance, but also how the processing may relate to the text. Essentially, the processing must be constrained by the text and guided by prior experience to contribute appreciably to both the successful resolution of the comprehension difficulty and criterial task performance.

2. What is the relationship between the recognition and nonrecognition of comprehension difficulty and recall performance?

Even though the relationship between the recognition of comprehension difficulties and recall performance in the C2 condition was statistically significant (rs = .4120 p = .032), this trend was not supported in both the C4 condition and in the group comparisons. The high and low recall groups did not differ appreciably in both the recognition and the recognition and initiation of action to resolve the comprehension difficulties. Considering the lack of a significant relationship between the recognition of comprehension failure and recall performance in the C4 condition, the lack of significant differences between the high and low recall groups in the recognition of comprehension difficulties and the rather low correlation between the recognition of comprehension difficulties and recall performance in the C2 condition, it was concluded that no clear relationship exists between the recognition of comprehension difficulties and criterial task performance.

This trend was also evident with respect to the nonrecognition of comprehension difficulties. The relationship between the number of misinterpretations in both the C2 and C4 conditions was not significant. Furthermore, no significant differences between the high and low recall groups in misinterpretations were evident.

These findings may further suggest that adult readers, if permitted, will spontaneously recognize comprehension difficulties when they occur. This is the case even though these adult readers may differ appreciably in their criterial task performance. Possibly for this population the recognition of difficulties alone and the text recall may not be related.

3. What are the types of comprehension difficulties identified by the participants?

Six types of difficulties were recognized by the participants:

I. Failure to understand a concept. In this type of difficulty the term may be novel, is known but does not make sense in the context, or several interpretations for the term are possible.

II. Failure to understand an idea unit. The participant can find little or no interpretation, the interpretation is vague and ambiguous, or the interpretation conflicts with prior knowledge.

III. Failure to understand how one idea unit relates to another. In this case the interpretation of one idea unit conflicts with another, the relationship between the idea units is not clear, and/or the idea units appear to be similar and the reader cannot detect a difference.

IV. Failure to understand how the sections of the text fit together. The participant cannot understand a major section of the text.

V. Failure to remember concepts, idea units and the necessary information. This was recognized as a mnemonic difficulty.

VI. In the cloze passage failure to insert an appropriate response and indicate an awareness of such. In this situation the participant either inserted the incorrect term, or the participant could not insert a term.

The first four types of difficulties were adapted from the taxonomy of comprehension failure originally proposed by Collins and

Smith (1980), while the remaining two emerged through the present analysis. Although the original taxonomy was not supported by previous research, it would appear that the findings of this study add credence to the original taxonomy proposed by Collins and Smith (1980).

Comparing the high and low recall groups, these groups did not differ appreciably in the recognition of Type I-VI difficulties in both the C2 and C4 conditions.

The high incidence of recognition of these types of difficulties indicates that adult readers are aware of many different types of comprehension difficulties. These relate to ideational, relational and mnemonic difficulties.

4. How do different reading situations affect strategy utilization?

All participants and particularly the low recall participants tended to increase their use of strategies in the C4 (Reading Cloze Concurrent Verbalization) condition in an attempt to resolve comprehension difficulties. This could be due to the large number of comprehension difficulties recognized relative to the C2 (Reading Concurrent Verbalization Recall) condition. However, this could also be due to the greater flexibility in strategy use. For instance, examining the expanded categories in the C4 condition, strategy use with respect to current reference and previous reference increased significantly for the low recall participants but not for the high recall group. Furthermore, the two groups did not differ with respect to the use of these strategies in the C4 condition. Consequently, with respect to these two strategies, the C4 condition may have encouraged the low recall participants to initiate more current and previous reference.

Interestingly, the use of the experiential application strategy in the C2 condition did not differ appreciably for both groups, however in the C4 condition this difference was significant. This suggests there was a tendency for the high recall group to recognize the need for a greater use of prior knowledge and experience in the cloze condition.

Although there appeared to be an increase in strategy utilization across conditions, the different conditions did not appear to appreciabily affect the quality of strategy utilization. The cloze condition facilitated the use of all strategies that appeared in the C2 condition. Three strategies, grammatical application, analysis of alternatives and intuitive action, were primarily restricted to the cloze condition. However, even considering these three strategies, it is apparent that with reference to monitoring the cloze condition facilitates the use of similar strategies as the noncloze condition. If one assumes that the C2 condition is a reliable and credible means for examining the reading process, and if strategy use in the C2 and C4 condition do not differ appreciably, then this provides support for the notion that the cloze procedure is also a valid tool for the examination of the comprehension monitoring process.

4.1 How does concurrent verbalization affect cloze and recall performance?

Concurrent verbalization does not appear to affect either recall or cloze performance. Essentially, the participants did not appear to differ significantly in recall and/or cloze performance across conditions. The one exception was with regard to text experiential responses. Overall participants tended to utilize significantly more prior knowledge in the C2 condition than the C3 condition. Methodologically these findings would suggest that concurrent verbalization used in conjunction with difficult text does not appear to inhibit recall of the information.

Perhaps automatic processing was inhibited by the text difficulty and the concomitant processing was already at a more conscious level. The task simply encouraged the verbalization of these thoughts. Another possibility was that the verbalizations were concomitant with processing and as such not retrospective. Since participants were encouraged to think aloud as opposed to talk about what they were doing, the verbalizations were not reflections as such but rather verbalizations reflecting ongoing cognitive processes. Furthermore, since a great deal of the processing because of the difficulty of the text involved monitoring, and since the monitoring was already conscious, the verbalizations again did not appear to affect criterial task performance.

5. What is the relationship between strategic application and cloze performance?

In addition to the high and low recall group differing appreciably in recall performance, these two groups also differed significantly with respect to cloze performance. Again the two primary strategies that contributed to recall as well as cloze performance were the conceptual binding and experiential strategies. With reference to the use of the experiential strategy, while the high recall participants appeared to recognize the need for the use of prior knowledge and experience to resolve comprehension difficulties in the cloze condition, this appeared to be less the case for the low recall participants. Furthermore, while the low recall participants tended to rely on Text Dependent forms of remedial action in this condition, the high recall participants utilized far more Multi-Interactional patterns of action in an attempt to remediate comprehension difficulties. This suggests that the use of Multi-Interactional patterns of remedial action contributes to both higher recall and cloze performance.

6. What are the general study procedures spontaneously used by the participants, and how might these procedures affect recall performance?

Macroprocedures were initiated by participants in response to the experience of not knowing or remembering (Type IV and V difficulties). Again participants differed considerably in the use of study or macroprocedures. The procedure consisted of text review in general, rereading key terms, rehearsal, underlining, note taking, underlining of notes, rehearsal of notes, and general review of notes. All participants in the C2 and C4 conditions initiated at least one review of the text, and this review, particularly for the high recall participants, was associated with a number of other macroprocedures. Of significance was the variability in macroprocedures between the high and low recall participants. In all conditions the high recall group utilized significantly more macroprocedures than the low recall group. It would appear that macroprocedures are primarily used in response to perceived criterial task difficulties, and the use of these procedures is related to criterial task performance.

In summary, as revealed by this investigation, the monitoring process is a highly complex cognitive activity. Readers as they attempt to resolve comprehension difficulties utilize a variety of strategies and these strategies are integrated into more holistic patterns of remedial action. The utilization of these patterns of remedial action are related to both the successful resolution of the comprehension difficulty and recall performance.

These findings emerged through the use of a research procedure in which the following components were viewed as important. First the participants took part in a number of reading situations; consequently data were obtained from a variety of sources and secondly the reading situations, particularly the concurrent verbalization conditions were structured to meet the participant's particular orientation to the task. This was accomplished through the use of a preliminary observation session as opposed to a training session in both concurrent verbalization conditions.

Although this investigation contributes to the knowledge of the monitoring process and methodological procedures for investigating this process, many questions remain. These questions and implications will be addressed in the following section of this chapter.

Implications for Further Research

This study has examined the complex process of comprehension monitoring with specific reference to the nature of strategic intervention initiated by the reader in an attempt to resolve the comprehension difficulty. Although this study presents a number of significant findings, these findings serve also to raise more questions which need to be addressed in future investigations. These questions relate to all aspects of the monitoring process.

The first aspect, recognition of comprehension failure, certainly necessitates further investigation. Essentially, how do readers recognize they are experiencing comprehension failure? and Why do readers recognize the areas of difficulty they do?

Although this study has defined a number of difficulties readers perceive as sources of difficulty, this investigation did not address how readers arrive at these decisions. For instance, how does a reader know they do not understand a concept or idea unit? How do readers recognize ideational and relational difficulties? How do readers realize they may have difficulty remembering the information, and why do some readers recognize certain difficulties and do not appear to recognize other difficulties?

How does the recognition of certain difficulties relate to the reader's interpretation of the criterial task? For instance, what does "remember" and "understand" the text mean to the reader and what are the implicit criteria readers may or may not have to examine their own quality of comprehension? In a more narrow vein if readers have a certain purpose in mind for reading a text, such as preparation for a multiple-choice examination, how do readers interpret this criterial task, and how does this relate to the recognition of comprehension difficulties and criterial task performance?

These areas can also relate to developmental aspects as well as populations of readers experiencing difficulty with the process of reading. In this area we need to examine how readers at different levels of cognitive experience differ with respect to the difficulties recognized and interpretation of the criterial task, and how readers at different levels of cognitive experience differ with respect to how they recognize difficulties have occurred.

With respect to more and less proficient readers, many of these questions also apply. For instance, how do readers at different levels of proficiency differ with reference to the recognition of comprehension difficulties, and the interpretation of the criterial task and/or reading purpose? Possibly through the examination of the types of comprehension difficulties recognized by the more and less proficient readers, this may provide the researcher with insights into how individual readers process the text.

Another area of importance relative to the recognition of comprehension difficulties is how the difficulties relate to the different aspects of the text. If the text can be examined in terms of idea units and the relationship of idea units, certain textual units and relationships may contribute to certain types of difficulties. This relationship of textuality and recognition of difficulties necessitates further investigation.

With respect to the second major aspect of the monitoring process, deciding whether or not to initiate some form of remedial action, a fruitful area of future investigation would be to examine how readers decide whether or not to initiate remedial action and how does this relate to the reader's level of cognitive experience, reading proficiency, and interpretation of the criterial task.

The area of strategic intervention is also open to further investigation, particularly with reference to the nature of the conceptual and experiential strategies utilized by readers to resolve comprehension difficulties. The use of prior knowledge certainly appears to contribute to the resolution of the comprehension failure, but considerable differences may exist in terms of how readers of varying cognitive experience and proficiency use this knowledge to resolve the comprehension difficulties. Since the use of reasoning appears to be a contributing factor in the resolution of the comprehension failure, the quality of reasoning, both in terms of development and proficiency, may be an area worth further study.

Another fruitful area of investigation would be to examine the relationship between the type of difficulty and the remedial action initiated. For instance, mnemonic difficulties may require qualitatively different forms of action compared to ideational difficulties. Furthermore, since difficulties may be related, for instance relational difficulties may be related to certain ideational difficulties recognized by the reader, the patterns of action may also be related to these relationships of difficulties.

The fourth aspect of the monitoring process, determining whether or not the action was successful, also requires further investigation. Essentially, how do readers know the difficulty was resolved, and how does this relate to cognitive experience, reading proficiency, and criterial task performance in general and recall in particular?

In order to deal with many of these questions, further development of the concurrent verbalization procedure is required. As suggested by Braun (1984), a possible adaptation of the procedure is to have two participants of relatively equal reading competence collaborate on a difficult text together. In this case the researcher could act as a third party and observe the interaction in a non-obtrusive manner. A further development of this procedure is to work collaboratively with a number of participants over a longer period of time, possibly the duration of a university term, in which the purpose of the task is more clearly defined in terms of the reader. For instance, individuals reading for a purpose they may ultimately consider significant, such as doing well in an examination or a course paper, may prove even more revealing.

Ultimately, many areas remain to be explored in how readers monitor their comprehension. The above suggestions are just a few that can be considered in future research.

Concluding Statement

Adult readers are able to recognize a wide variety of comprehension difficulties. In general, these include ideational, relational, mnemonic difficulties, and difficulties more explicitly related to the criterial task. These readers are then able to make some decision as to whether or not some form of remedial action should be initiated. Although not clear in this study, this decision would in some part be influenced by readers' interpretation of the criterial task. If remedial action is initiated, the nature of the action consists either of a Text Dependent, Text Dependent Interactional, Reader Dependent, Reader Dependent Interactional, or a Multi-Interactional pattern of remedial action. The Multi-Interactional pattern of action was most highly associated with both the successful resolution of the comprehension failure and improved criterial task performance.

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APPENDICES

APPENDIX A

PRELIMINARY PASSAGES

CONCRETE OPERATIONS

Concrete operations are characterized by the furthering of cognitive progress in a number of areas. Most notably this occurs in additive classification, multiplicative classification, the understanding of relationships and the conservation of matter.

Concrete operations refer to the idea that students in this stage can perform logical operations if these operations are performed on real or concrete objects. A child who has reached this level of development, when asked if there are more boys or students in the class, will be able to think this problem through (with the aid of concrete props in the form of students in the class) and conclude that there are more students. It should be stressed that the concrete operational child needs physical props to perform cognitive tasks successfully. The same child would probably encounter difficulties if asked to solve the following problem:

All A is B.
Some B is C.
Is all A, C?

However, this student would probably be able to figure out the following problem:

All mammals are animals.
Some animals are herbivores.
Are all mammals herbivores?

Additive Classification

The beginning of additive classification is noticeable in preoperational thought. For instance, the preoperational child, when given an array of blocks of different shapes and colors, will form inconsistent classes, sometimes grouping on the basis of color and sometimes on the basis of shape. Furthermore, the early preoperational child may also have difficulty with exhaustive sorting in which all of the objects that belong in a class are placed there. Instead, the two to four year old will place some objects in a class but forget to place others. By the time the child reaches first grade (approximately corresponding to the onset of the concrete operational period), the child can take an array of objects and sort them consistently and exhaustively.

Multiplicative Classification

Another classification skill that is added during the concrete period is the ability to utilize multiple classification schemes. At the beginning of this period children have difficulty classifying an array of multicolored and multishaped blocks first by color and then by shape. It appears that these children do not see the first classification system as an arbitrary scheme that can later be rejected in favor of another. Later in this period up to 90 percent of the children are able to gain cognitive flexibility and arbitrariness of classificatory systems.

Understanding of Relationships

The concrete operational child is also more readily able to understand relationships and classify objects hierarchically. For example, when given an array of different shaped and colored blocks, the concrete operational child can first divide them by shape and then by color. Consequently while the preoperational child thinks in absolute terms, light or dark, big or small, and does not seem to understand relational terms, the child in the period of concrete operations thinks in terms of longer, higher, and wider. He realizes that a brother must be the brother of someone, an object must be bigger or smaller—or to the right or left—compared with something else. When he is given a set of sticks, he can easily arrange them in order of size. The overall plan or strategy in classifying and seriating can confirm that he understands the relationships among observations.

Conservation of Matter

Another major advance during this period is the development of the ability to conserve. Conservation refers to the child's ability to understand that certain properties like weight and volume are not changed by operations like pouring and flattening. Two simple experiments illustrate this notion. Children are shown two identical glasses with identical amounts of liquid in them. The liquids are then poured into a short wide glass and a narrow thin glass. When asked if the two amounts (volume) of liquid are now the same or different, the nonconserver will say there is more in the tall glass. In a similar type of problem with clay or play dough, children are asked to weigh two identical balls of clay. Having determined that they weigh the same, the students then watch as one of the balls of clay is flattened out and made longer. When asked again if the two weigh the same, the nonconserver will say that the longer one weighs more. The conserver, on the other hand, will answer they are still the same because only the shape has been changed.

One explanation for this difference is focus: the nonconserver focuses on only the salient or obvious aspects of the problem, disregarding other variables. In the liquid volume problem, the nonconserver focuses upon the greater height of the tall, thin glass, disregarding the width of the shorter one. Another explanation is the notion of reversibility: the mental ability to invert a sequence of steps to return from the final condition to the initial. In other words, it involves the ability to realize that if the two liquids in the different shaped containers were poured back into their original containers, they would have the same volume. However the ability to conserve is explained, it constitutes an important cognitive process. Without it, simple transformations would not be possible.

In summary, significant progress is made during the concrete operations stage in the development of conceptual thinking. Most notably this change occurs in the operations of additive and multiplicative classification, conservation, and the recognition of relationships.

(Adapted from Kauchak and Eggen, 1980,
pp. 64-66; Mussen, 1973, pp. 34-35.)

INFERENCES: GOING BEYOND THE INFORMATION GIVEN

Extensions and interpretations of observations are called inferences, and it is through the process of inferring that much of our understanding of the world is accomplished.

Inferences are statements that are based upon observations, but include more than just the observations themselves. As such, inferences are extensions of observations and serve to group together (categorize), summarize (generalize), predict, or explain.

Categorizing Inferences

Categorizing inferences involves grouping together two objects on the basis of some similarity. These inferences occur frequently in our lives. For example, a young girl at the seashore makes a categorizing inference when she makes piles of shells on the basis of colour, shape or design. Another form of categorizing occurs when children group baseball cards on the basis of league, team, or position. Adults make these inferences when they notice that two records sound alike or two foods taste alike. In all of these examples there are two common characteristics. The individual first encounters an array of uncategorized objects and then places them in groups on the basis of some commonality.

Categorization activities can vary in their difficulty, depending on the number of objects to be classified and the thoroughness of the classificatory scheme required. For example, three objects are easier to classify than ten because the individual needs to observe only three objects and find a commonality between two of them. An individual who encounters ten objects and is required to make only two classes has an easier job than someone who has to make three or four.

Generalizing Inferences

Generalizing inferences serve two complementary functions. The first is to summarize data to simplify it and make it easier to remember. The second function is to extend the summary to include cases not yet observed. In other words, a generalizing inference is used to condense a set of observations into usable form and extend this summarization to a larger set of observations.

The process of generalizing (forming generalizing inferences) is common in our everyday life. It is a critical skill because it is the process through which we form not only generalizations but also concepts about the world. In forming concepts we infer characteristics to a total category on the basis of our observation of a subset of that category. For example, the small boy who encounters his and other children's dogs observes characteristics such as fur, four legs, tail wagging, barking, hand licking, and so on in these dogs. His concept of dog then includes those characteristics and he will expect other dogs that he encounters also to wag their tails, bark, and lick his hand; that is, he has inferred these characteristics to exist in dogs he has not encountered. The concept he has formed summarizes his past observations and extends these observations to examples of the concept not yet encountered.

Predictive Inferences

A major value of concepts is that they allow us to infer characteristics of the concept to new examples that we meet. The boy will, when encountering a new dog, expect that dog to lick his hand. In doing so the child has formed a predictive inference that involves using past observations to suggest what a future observation will be.

Predictive inferences are related to generalizing inferences in several ways. First, predictive inferences are based upon generalizing inferences. In the previous example, the boy could not have predicted that the dog would lick his hand had he not already generalized that dogs are hand lickers. People make predictive inferences based upon other inferences so often that the difference between the two types of inferences is often obscured. For example, the person who throws a ball up into the air and then extends the hand to catch it is performing an action based on a predictive inference. The inference that the ball will come down is based upon the generalizing inference, "What goes up, comes back down." Countless human activities are predicted on just such a relationship between generalizing and predictive inferences.

Explanatory Inference

A fourth type of inference used by people to process information and, consequently, to help make the world around them comprehensible, is the explanatory inference. As the name suggests, an explanatory inference is used to explain observations. As a simple, commonplace example of this process, consider the case of a small girl who daily is observed watching Sesame Street on television. Through our observations of her daily viewing habits we could infer that the child likes the program. Our inference that the girl likes the television program explains why she is watching it.

(Adapted from Kauchak and Eggen, 1980, pp. 37-43.)

THE QUEST FOR EQUILIBRIUM

Cognitive equilibrium is maintained through the processes of adaptation, accommodation, assimilation, and organization. Essentially we all attempt to make sense out of the world around us by processing information into regularities. By forming these patterns we attempt to make the world understandable, changing the old structures if they don't work well and forming new patterns or regularities when old ones don't fit. When the regularities we have do an adequate job, that is when they allow us to describe and explain what's going on out there, we are in a condition called equilibrium. This condition exists when our mental structures are adequate to understand the world around us. When these regularities or structures are inadequate, people are motivated to search for ways to revise them. These structures are revised through the processes of adaptation and organization.

Adaptation

Adaptation is the individual's constant effort to understand the surrounding world through the processing of information. In doing this, the regularities already formed are often adequate. For example, if you looked up from this page to the room around you and saw familiar sights and objects, the regularities that you have would be adequate to describe or explain these sights. If something that you saw is out of place or strange (if there were an elephant in the room), then your mind would attempt to form an explanation to account for this discrepant information. Adaptation occurs when the individual interacts with the environment and either understands that environment (achieves a state of equilibrium) or tries to figure out why he or she does not.

Adaptation occurs through two complementing and reciprocal processes, assimilation and accommodation. Assimilation refers to the process of interpreting or viewing the external world according to structures (regularities that he already possess). For example, when a small girl eyes a four-legged animal and says, "Doggie," she is assimilating the information she is receiving about the animal (four legs, brown and white fur) into her existing cognitive structure. Everything is fine for the child until the animal walks up to her and meows. Then accommodation must occur.

Accommodation

Accommodation refers to the processes of changing existing mental structures or patterns in response to the realities of the environment. Accommodation occurs when we learn something new, when we change or minds on a position because of new information, or when we change our attitudes about a person or groups of people because of experiences we have had. When accommodation takes place the content of our minds—concepts, generalizations, attitudes and views—changes to make them more in line with the real world around us. The young child encountering the animal had to do this when the "dog" meowed. According to past experience, dogs bark and don't meow. In attempting to reconcile or accommodate her mental structures or ideas with this new experience, she had two options: to conclude that dogs do indeed meow or to conclude that not all small, four-legged animals are dogs.

Assimilation

Assimilation involves the person's dealing with the environment in terms of his structures, while accommodation involves the transformation of his structures in response to the environment. Although conceptually distinct, these processes are simultaneously present in every act. To illustrate: suppose an infant of four months is presented with a rattle. The child has never before had the opportunity to play with rattles or similar toys. The rattle, then, is a feature of the environment to which he needs to adapt. The infant tries to grasp the rattle. In order to do this successfully he must accommodate. First, he must accommodate his visual activities to perceive the rattle correctly; then he must reach out and accommodate his movements to the distance between himself and the rattle; in grasping the rattle he must adjust his fingers to the shape; in lifting the rattle he must accommodate his muscular exertion to its weight. In sum, the grasping of the rattle involves a series of acts of accommodation, or modification of the infant's behavioral structures to suit the demands of the environment.

Grasping the rattle also involves assimilation. In the past the infant has already grasped things; for him, grasping is a well-formed structure of behavior. When he sees the rattle for the first time he tries to deal with the novel object by incorporating it into a habitual pattern of behavior. In a sense he tries to transform the novel object into something that he is familiar with, namely a thing to be grasped. We can say, therefore, that he assimilates the object into his framework.

Organization

The product of this process of adaptation is a new or modified organization. Essentially when we learn something new, we can say that the organization of our mind has changed. This change might consist of the addition of a new fact, concept, or generalization, or it could consist of the altering of an old regularity. For example, if a student who has previously thought of mammals as having four legs finds out that whales are mammals, the concept of mammal changes and a change in organization occurs. A new or modified structure results and some semblance of equilibrium returns to the cognitive system.

(Adapted from Kauchak and Eggen, 1980, pp. 53-58 and Ginsburg and Opper, 1969, pp. 18-19.)

THE SCIENTIFIC PROCESS

The scientific process is a naturally occurring part of our lives. In addition to this feature science is characterized by a search for regularity, observation, and information processing.

Search for Regularity

The first and probably most important feature of the scientific process is the search for regularities. A regularity is a pattern that has occurred in the past and can be expected to occur again in the future. The world is full of regularities such as: the sun rises in the east and like poles of a magnet repel while unlike poles attract.

Defining science as a search for regularity implies a dual nature of science. On the one hand science is a search, which implies a continuing activity. This is the process aspect of science; in the search for regularities, people engage in certain processes, such as observing and inferring. The other dimension of science is the product or content of that search—the facts, concepts, and generalizations that scientists have formed. One way to distinguish between process and product is to think of the process dimension as the doing component of this process. While the actual forming of regularities involves the process nature of science, the regularities once formed refer to the product or content of science.

Science as a Naturally Occurring Part of our Lives

Science is a naturally occurring phenomenon and people often act as scientists without even knowing it. For example, shoppers will often go to several stores, stopping at each for particular items. Through their experience they learn that certain stores have better produce, others have better meats, and still others have cheaper canned goods. These conclusions are reached through observations the people make as they shop. From these observations, regularities are formed which are used to guide future shopping behavior.

A person is also doing science, for example, when he or she varies a recipe slightly and notes the changes in the final product. It also occurs when someone attempts to change his or her behavior and watches what effect this new behavior has on other people, or when a teacher uses a new teaching technique and observes what effect this technique has on student performance. All these people are attempting to find patterns in their world by shaping their observations into recognizable forms.

This search for regularity and permanence is primarily initiated, in young children, by the development of object permanence. The development of this generalization, that objects and events remain the same time after time, is illustrated by the child who listens to and expects a story to sound the same way every time.

Science is Based on Observable Data

So far we have said science is an attempt to form patterns, and it is a natural activity for people. A third characteristic is that the regularities formed are based upon observable data. This is in contrast to nonscientific activities in which people form conclusions on the basis of opinions, feelings, superstitions, or authority.

For instance, historically, people described illnesses in terms of evil spirits. These people were not involved in the process of science, because their conclusions were based on superstition rather than observable data. Later when people formed the generalization, "Disease is caused by bad air," the process they followed could be considered scientific, even though this belief is not currently accepted. The regularity formed was based upon the evidence that closing the window at night prevented the sickness. From this observation they concluded that sickness was sometimes caused by the air itself. In time, however, the idea of humours became harder and harder to accept because it failed to explain these other observations: mosquito netting prevents malaria, physically fit people are less susceptible to disease than unfit people, and people who keep themselves clean are sick less often than their dirtier counterparts. Because the idea of humours was unable to account for all the observations, a new explanation was sought and the germ theory of disease was born. This theory is accepted today not because it is inherently "right" but because it explains our observations better than any other competing theory. Consequently for an activity to be called science there must be a search for some pattern or regularity and this search must be based on observable information rather than intuition or superstition.

Science is Information Processing

We have seen that science is characterized by a search for regularities or patterns based on observable data; in order for the process to be considered scientific, people must form the patterns on the basis of the information rather than intuition or superstition.

In doing so they take single items of information, summarize the information and transform it into regularities that are more usable than the isolated pieces themselves. This activity, called information processing, is a fourth major characteristic of science. For example, the statement "Disease is caused by bad air" was based on observations or information about how closing windows could prevent malaria. Information processing occurred when these separate observations were summarized in a generalization.

(Adapted from Kauchak and Eggen, 1980, pp. 3-15.)

DEVELOPING CHILDREN'S ABILITIES TO WRITE EXPOSITORY MATERIAL

The following teaching/learning strategies, when used in conjunction with one another, can be utilized to help children develop their abilities to write expository material. This instructional sequence includes factstorming, categorizing, paragraph drafting, paragraph sequencing, developing introductory and summary paragraphs, and organizing the paragraphs into a cohesive report.

The remainder of this text describes this sequence of instructional strategies.

Factstorming

A basic strategy for introducing students to the structures through which informational content is expressed in written form is factstorming. Factstorming is the process in which students randomly call out phrases that come to mind on a topic while scribes record these on chart paper or the chalkboard in the order given. To be productive, of course, factstorming must be based on a data-gathering activity. For example, students may view a film or filmstrip or listen to an informational passage shared orally by their teacher. They may gather information through interviewing or through a field trip. They may read several references on the topic. Or they may collect data through a combination of approaches that are part of unit study. In any event, students must have informational background to bring to the factstorming.

Categorizing Facts

The next strategy in the instructional sequence is categorization, or the systematic organization of facts "stormed." This can be achieved in several ways, depending on the sophistication and previous experience of students with the process. One way is for the teacher to select an item of information laid out on the board and ask students to locate a second item that is in some way like the first. Students tell how the two items are related, circle them, and locate other items that share the same relationship, circling them in the same manner. Having developed one cohesive category of facts in this way, students proceed to organize the remaining facts into other categories according to shared relationships, indicating related items by circling them with different colored markers.

For example, if youngsters are completing a unit on environmental pollution or have viewed a filmstrip on this topic, they begin by factstorming words and phrases related to the pollution. Then they categorize facts given, perhaps grouping together such items as automobile exhaust, forest fires, smoke stacks, burning sulphur coal, and so forth because these relate to air pollution. They circle these items with a yellow marker. In like manner, they circle with blue such items as chemicals, human wastes, and trash because these are forms of water pollution. Through analyzing in this way, young thinkers can develop a series of informational categories related to the larger topic of environmental pollution.

Drafting Cohesive Paragraphs

Once students have grouped related points into labeled categories, they can begin the next step—drafting short paragraphs based on each of the categories. Again there are several ways of proceeding. With youngsters who have had little experience drafting informational paragraphs based on one main idea, a good introductory strategy is teacher-guided group writing. Guiding either the total class or a small writing team, the teacher focuses attention on one category of information previously charted and encourages children to compose sentences on this topic. The teacher or a student scribe records sentences suggested and then guides the students in revising what they have drafted. The teacher may also ask students for a general statement to use as a summary at the beginning or end of the paragraph. He or she may ask students to reorder the sentences drafted so that they flow more logically, to combine two sentences into one, to substitute a more expressive word for one used, to write another sentence that supplies added information. In short, children and teacher together mark over, cross out, insert, reorder, and finally title their paragraph.

Sequencing Paragraphs into a Logical Whole

Having drafted and edited paragraphs, students can share them by recording copies on a chart or the chalkboard. Now the task is to decide on the order in which the individual paragraphs can be combined into a composite report. Students reach a consensus by talking about possible orders and the advantages and disadvantages of each.

Drafting Introductions and Conclusions

After students have sequenced their collaborative report, they can talk out the content of an introductory paragraph, cooperatively frame a beginning sentence, and dictate several supporting sentences that can be part of the introduction to their report. Again, this work can be handled as a teacher-guided group writing activity; the teacher asks questions that encourage students to think of a good beginning sentence and to identify key content that is to follow in the body of the report. In the same way, students can formulate either a summary paragraph or one that proposes generalizations based on the content included in the report.

Organizing the Parts into a Cohesive Report

Once students have drafted an introductory paragraph, decided on an order for the paragraphs they have composed, and drafted a concluding section, a group of three compositors goes to work. Their task is to put together a final draft of the class report, replete with subheads based on the titles given by writing groups to the individual paragraphs. Their work is eased if the class has gone back to edit all the paragraph titles so that they have a uniform structure. This editorial work in elementary grades must be teacher guided; the teacher must raise questions that help children define the main idea of each subpart.

In this sequence students can become active constructors of content. Through factstorming, categorizing of facts stormed, drafting paragraphs that focus on one category of fact, sequencing paragraphs, drafting introductions and conclusions, and organizing the parts into a cohesive report, students develop an understanding of how informational content is structured and written.

(Adapted from Hennings, 1982, pp. 8-17)

HELPING CHILDREN DEVELOP SKILL IN PHONIC ANALYSIS

Phonic analysis helps beginning readers translate printed words into familiar spoken words. As a tool phonics can help the beginning reader to make a more informed guess as to the oral equivalent of a printed word. A number of procedures have been suggested by both pedagogs and researchers to teach children the relevant aspects of this process. The following is one such procedure.

Step 1

Provide meaningful contact for introducing those words which contain the phonic signal you wish the children to learn. Utilizing a whole-word phonics approach the children are introduced to the most common graphemes and their respective phonemes. Rather than being introduced to them in isolation, they are introduced in the context of words and sentences and often in stories as well. For example, for introducing the "ch" grapheme, the children are shown such words as church, chin, and chop. These words are pronounced by the teacher and then the children. They are shown or they discover that the /ch/ sound is spelled "ch" in these words.

To illustrate further, when teaching the long "a" in the VCE (vowel, consonant, silent "e") pattern, children could be introduced to several sentences containing the pattern. The teacher would underline those words which demonstrate a long "a" in a VCE pattern. For example:

He put it in a jar to keep it safe.

He saw a snake in a rocky place.

Step 2

Lead the children to the discovery of the common phoneme in each word and provide them with practice in recognizing and saying that sound with minimal distortion.

To continue with the example of a long "a" in a VCE pattern, read the sentences to the children, moving your hand smoothly under the words as you read. Then have the children pronounce each underlined word after you. Ask them what sound is the same in each underlined word. Have them make the vowel sound with you. Call it the "long a sound."

Read several words to them such as hate, hat, rat, rate, rope, cap, cape, car, paste, and past. Have them close their eyes and put up their hands whenever they hear a word which has a long "a" sound in it.

Step 3

Lead them to the discovery of the common letter in each word and provide them with practice in recognizing those letters in words.

The emphasis in this step is on seeing the differences in letters rather than hearing their related sounds. To continue with the above example, refer to the underlined words in the sentences. Ask them what letters are the same in each underlined word. Point out to them that the long "a" sound is often spelled with an "a" in the middle of the word and an "e" at the end. Put other words on the chalkboard or chart (same words used in Step 2) and ask each child to come up and circle a word which probably has a long "a" sound in it.

Step 4

Discuss the regular spelling pattern (if it is demonstrated in the lesson) and have them make up a "rule" if the pattern is one which is common and reasonably consistent.

To continue with the previous example, above the underlined words write the letters VCE to correspond to the last three letters in each word. Remind the children that "V" stands for a vowel letter and tell them that "E" stands for a final "e." Ask them what "C" stands for (It stands for either a consonant letter, digraph, or blend). Ask them whether the circled words also have the VCE pattern. Write words like these on the board or chart: fame, frame, made, made, hat, and hate. Have children label those which have a VCE pattern. Ask them what vowel sound they hear in the labeled words. Ask them if anyone can make up a "rule" about the sound of "a" in words having a VCE pattern. Accept anything approximating this: "The letter 'a' usually has a long vowel sound in words that have a VCE pattern." For contrast, label those words with a VC pattern and briefly discuss the difference in sound and spelling pattern between words like mad and made, hat and hate.

Step 5

Use the substitution technique to provide them with practice in decoding words which have not yet been introduced in the lesson. In the substitution method children are taught to use known sight words to unlock new words. To illustrate, put word pairs like these on the board or chart: lice and lace, line and lane, coke and cake, spice and space, mote and mate. For each pair tell them what the first word is and ask a child what the second is, e.g., "This word is lice. What word is this?" (Have at least one pair for each child in the small group.)

Step 6

Provide additional practice by having children make up family words. For example, the teacher can ask the children to think of words that rhyme with lake. Write them on the board as they say them, placing them in a vertical column so that the VCE pattern is emphasized. When a word has a homophone, such as brake and break, and you think the child may be referring to the homophone which doesn't fit the VCE pattern, put both spellings on the board, but put the one which doesn't fit the pattern in a separate column.

Step 7

Provide practice in context. For instance, the instructor can put a few sentences such as the following on the board (or better yet, put them on a chart prior to the lesson):

She gave me her (hate) (hat) to wear.
I did not save my cake. I (at) (ate) it.
I have a (rat) (rate) in a cage.
She came (paste) (past) the lake.

After reading the underlined words with the children, ask them if all the underlined words have a long "a" sound in them. Point out that the VCE pattern usually indicates a long "a" sound but not always, e.g., "have": "You have to check to see if the way you say the word makes sense in the sentence." Then for each sentence have a child go up to a board and circle the word in parentheses which "makes sense in the sentence" and then read the complete sentence out loud—with your help, if necessary.

(Adapted from May and Eliot, 1978, pp. 35-49)

TEACHING CHILDREN HOW TO FIND PART-WHOLE RELATIONSHIPS IN READING MATERIAL

Children may be taught how to find part-whole relationships in the material they read through an instructional procedure utilizing both concrete and abstract concepts. Initially only concrete and familiar units are used, however as learning progresses these units should become more abstract. At all points children should explore how these concepts are related, through the discovery of superordinate, coordinate and subordinate relationships. Finally the skill and procedure learned should be applied to a realistic reading task.

This notion is examplified in the following procedure, utilized to teach children how to find part-whole relations.

1. The first stage uses concrete objects to identify relationships. To illustrate, the following exercises can be used.

    a. Present a group of objects. Ask pupils to find the one that represents the whole and to explain how they all go together. (e.g., Present a page with text, a book back, a book jacket, a whole book, and a page with a picture.)

    b. Present a group of objects. Ask pupils to suggest an object which would represent the whole idea of all the units and to explain the relationship. (e.g., Present a news report, a crossword puzzle, an ad, and a headline, all cut from a newspaper.)

    c. Present a group of objects. Ask pupils to find one that is not related to the others and to explain the reason for the selection. (e.g., Present miniatures of a bed, pillow, chair, blanket, and sheet.)

d. Present an object (a play house, perhaps). Ask pupils to suggest related items and to explain how their suggestions would be related.

The teacher and pupils then summarize the thinking process involved in the exercises, making certain that the children recognize that they have been identifying whole ideas and parts that are related to them.

2. The sequence of four exercises may then be repeated with groups of pictures. This removes the target of observation to a more abstract plane.

3. The third stage of skill development uses word groups. Introducing them, let the children know that they will be asked to apply the same skill that they have been using with objects and pictures.

Following the same sequence outlined for objects, present the following word groups: (a) nose, eyes, face, mouth, chin; (b) fingers, palm, wrist, elbow; (c) hair, head, ears, chin, toes.

4. The next step may extend the skill to phrases and short sentences. Children need guidance to find the key words in sentences.

The following phrases are an example of an exercise at this step: (a) her birthday party, eat cake, good friends, a few presents, to play games; (b) the green pants, my brown jacket, pair of tan shoes, my blue shirt; (c) many houses, the bright sun, heavy traffic, tall buildings, dirty sidewalks.

In working with phrases, the discussion should focus on distinguishing the main or topic idea of each phrase and the minor details of the supporting ideas. In example "c" above, the item to be discarded is extraneous to the group rather than irrelevant. This example follows the form of written selections, in which all the ideas have some relation to the main idea but they may not all be germane to the central topic.

5. The children may then be asked to read a paragraph, such as the one below, to find what it is mostly about and to find the parts of a whole thing that is being described. The teacher should remind the pupils that they are to apply their thinking skills as done in the exercises.

> Baboons inhabit the long, dry regions of Africa. They have short bodies, and their fore and hind limbs are almost the same length. Their feet, however, are exceptionally long. The palms and soles of the feet are placed on the ground when the baboon is walking. The mouth is more like a wolf's than a monkey's. The strong jaws are armed with powerful teeth, useful for protection as well as eating.

The questions which follow the reading should ask for the main idea and for details. All answers, right or wrong, should be discussed so that the comprehension strategy is clear.

6. Next, the teacher should explain that authors often use more than one paragraph to discuss an idea. Then use paragraphs to "chunk" small groups of details to help the reader take in small bits at a time. Readers can find parts of an idea in each paragraph and

put them together to find out what the author is trying to say.

At this point the youngsters should be presented with two related paragraphs and asked to apply the same strategies they have employed in all the preceding exercises. Space does not permit inclusion of lengthy samples here, but it is an important step on one way to working with real-world reading, which rarely consists of single paragraphs.

7. The lesson is not complete until it reaches the stage of application to real reading, a selection longer than two paragraphs in a book, a newspaper, or a magazine. It is at this last stage of the lesson that the children have the satisfaction of having learned a relevant skill. The teacher has evidence that her pupils have obtained information from their reading and have attained a useful comprehension skill.

(Adapted from Kachuck and Marcus,
1976, pp. 158-160.)

SEVEN STEPS TO TEACHING BEGINNING READERS TO SPELL

English orthography is not a system that is dominated by the surface sounds of spoken language. To learn to spell is not to get in the habit of associating sounds directly with letters. Rather, English spelling is dominated by underlying sound segments which convey meaning. Learning to spell is a matter of acquiring knowledge rather than habits—in this case, knowledge of how the alphabet reflects meaningful language.

How then may these principles be applied to teaching beginning readers to spell? For kindergarten or first and second grade teachers, we would identify seven steps for becoming a better teacher of spelling, and thereby of reading and writing.

The first step is to encourage creative writing. Allow children to assume active roles in acquiring written language. Children must manipulate and discover words. They must test their theories of how the alphabet works by contrasting their productions with standard orthography. Children do these things when they are encouraged to write independently. Such encouragement guides them to the threshold of acquiring written language facility.

To illustrate this is a story written by an average reader in the first grade.

> MOIE [My] Dad ran in the MRATHON [marathon] and WEN [when] he came home he had a INGRD [injured] LEGA [leg] but it WUS [was] ONELEE [only] a WECKEGO [week ago] and he CUD [could] WOC [walk] on the THRD [third] day.

The story is meaningful and well written in terms of clarity and expressiveness. The student's teacher will type the story supplying the standard spelling and put it into the class book. When this child and his classmates read and reread the story, they will be exposed to standard spelling, but the integrity of his original production is never questioned.

Step two for teaching beginning readers to spell is to de-emphasize standard spelling. In the primary grades, children must be encouraged to spell as best they can and not be held accountable for adult spelling standards.

To require adult standards of their beginning spellers seems a bit preposterous, especially when it is not uncommon to hear teachers report that their children cannot spell or that writing should be pursued only after some standard of correct spelling can be maintained.

A primary teacher who de-emphasizes standard spelling is less concerned with correctness than with understanding the reasoning process that a child has used to arrive at a particular spelling. Of course, a child's reasoning process cannot be examined directly. But a teacher can examine a child's nonstandard spellings and infer the quality of a child's knowledge of words as well as the child's conceptualization of written language.

This leads directly to step three. At this point the teacher examines the child's nonstandard spelling and attempts to deduce the spelling strategies utilized by the student.

For instance, a child who spells "monster" as "monstr," "dressing" as "dresing" and "bottom" as "bodm" is employing a phonic spelling strategy. On the other hand, a child who spells "monster" as "amt," "dressing" as "demaAps," and "bottom" as "btnhm" appears to be using a random ordering of letters he can write to spell the words.

Step four involves the selection of relevant spelling patterns and words to be taught. For instance, a child who is using a strict phonetic strategy should be given the opportunity to manipulate words so that the relationships among spelling, meaning and phonology become clear. The teacher may point out a word that the child does know which begins with the same sound—track, tree, truck, or trick. The child should be permitted to contrast these words with words that begin with "ch"—Chuck, chick, church, and chat. Conceding that all of these words have some similarity in beginning sounds, the informed teacher would point out that track, tree, and truck also begin like tip, tap, and top. Finally, the teacher would have the child categorize the words according to their standard spelling, those that begin with "t," those that begin with "ch," and those with "tr."

Step five involves the positive transfer of knowledge. Essentially when the child learns a pattern and this principle helps in the mastery of new words, positive transfer has taken place. For instance, if a child knows that more than one dog is spelled dogs, he can transfer and guess correctly that more than one pig is spelled pigs. Furthermore if the child knows how to spell track, tree, and track, he may also be able to spell trick.

Step six primarily involves appropriate practice. In addition to the learning of spelling principles and patterns, children should also learn relevant words. Although most children may develop their own method for effective learning, some may not. However, for those children who do not appear to be able to develop a systematic procedure the teacher should provide one and attempt to see that it is used. The following procedure is widely advocated and has been found to be effective.

1. Look at the word and say it aloud.

2. Cover the word and try to imagine what it looks like. It might help you if you close your eyes.

3. Open your eyes but keep the word covered. Write the word down.

4. Uncover the word and compare it with what you have written. If you misspelled the word, try again (Steps 1-3).

5. Have someone read your spelling words to you. Write them down as you hear them. Check your spelling and relearn those you have missed.

Step seven primarily includes the application of the knowledge to context. In this case the children should be given the opportunity and encouragement to utilize this knowledge in their daily writing activities.

(Adapted from Gentry and Henderson, 1978, pp. 632-638; Lundsteen, 1976, pp. 347-349; and Johnson, Langford and Quorn, 1981, pp. 584-585.)

WORD RECOGNITION

Word recognition is the process of decoding printed words through the use of a number of skills. Most notably these include visual memory and phonic, structural and contextual analysis.

Phonic Analysis

Phonic analysis requires three interrelated steps: (1) the recognition of phonic signals consisting of graphemes and grapheme patterns, (2) the translation of graphemes into phonemes and (3) the blending of the phonemes aloud or silently into a single syllable or word.

A phoneme is the smallest unit of meaningful speech. Over forty phonemes in the English language have been classified, although linguists don't agree on the exact number. Linguists discover the different phonemes in a language by determining what changes in speech sounds indicate changes in meaning. For example, the first phoneme in the spoken word "bet" is the "b" sound, represented as /b/. If the first phoneme is changed to /p/, we have a change in meaning from "bet" to "pet."

The grapheme is a written symbol used to represent a phoneme. There is not a direct correspondence between letters and graphemes, consequently these should not be viewed as synonymous. For instance, in the word "chin" two letters are used as one grapheme to represent a single phoneme. Graphemes consist of the following: (1) Consonant letters—a single letter used to represent a speech sound called a consonant; (2) Vowel letter—a single letter used to represent a speech sound called a vowel; (3) Consonant digraph—two consonant letters used in combination to represent a single phoneme; (4) Vowel digraph—two vowel letters used in combination to represent a single phoneme; (5) Consonant blend—two or three consonant phonemes slurred together; and (6) Diphthong—two vowels blended together.

For the reader this knowledge is merely one tool to use in making an intelligent guess as to the oral equivalent of a printed word. In nearly every case it is best to temper phonic analysis with structural and contextual analysis.

Structural Analysis

Although phonic analysis may be necessary for a child who is first learning to read and is sometimes required by the mature reader, it is generally a slow method of decoding. It is especially slow when the reader finds it necessary to decode every letter, digraph or blend in a word one at a time, e.g., u-n-s-e-l-e-c-t-e-d. Therefore the same time the teacher is giving students a firm foundation in phonics, he or she should begin to reduce their possible overreliance on phonic signals. One way of doing this is to gradually introduce children to structural analysis. This procedure is comprised of syllabic and morphemic analysis.

Whereas syllabic analysis involves the translation of graphemes or grapheme clusters into units of sound, morpheme analysis necessitates their translation into units of meaning. Let's take the word revisited as an example. Syllabic analysis (along with phonic analysis) of the word would lead eventually to re/vis'/it/ed. Morphemic analysis, on the other hand, would lead to re-visit-ed. Morphemic analysis is a quicker, more mature form of analysis, but one which generally relies on the visual memory of roots (such as visit), the visual memory of inflectional endings and other suffixes (such as "ed") and the visual memory of prefixes (such as "re").

Teaching children to recognize morphemes and syllables can begin very early in a developmental program. It is possible to introduce the word cats, for example, shortly after the word cat has been thoroughly learned. After several experiences of decoding singular and plural nouns, the child will learn to recognize the inflectional ending "s" and to realize intuitively that the word cats represents two separate morphemes—"cat" and "s"; and that the addition or subtraction of the morpheme "s" changes the meaning of the word.

In addition to an introduction to morphemic analysis, children can also be introduced rather early to syllabic analysis. Words such as rabbit and cotton, for example, lend themselves to simple clapping or stamping exercises which illustrate the two distinct syllables or "grunts" represented by each word. This type of primitive analysis would eventually lead to a more sophisticated analysis of those particular grapheme patterns which indicate a separation of syllables. In the word rabbit, for instance, the reader can see two vowel letters separated by a pair of consonants. This pattern, the VC/CV pattern, indicates that two syllables should be uttered and that the break in syllables is between the two consonant letters. Having broken the word rabbit (or any other VC/CV word) into syllables, the child is then able to look for familiar phonic patterns in each syllable. In the case of the word rab/bit, for instance, it is easy to recognize the

VC spelling pattern in each syllable, and this would signal a short vowel sound—at least for the accented syllable.

The process of dividing words into syllables, called syllabication, is subject to the same type of limitation that exists with phonic analysis. There are few syllabication rules that one can consistently rely on. As with phonic analysis children should be taught to take chances and be willing to make mistakes. Flexibility is imperative. Consequently, children should be taught to try another method of decoding the syllables if the first one doesn't work.

Visual Memory

To become a skillful reader, the child must also acquire a large reservoir of sight words. Consequently, children need to be assisted in developing their visual memory of words so that they don't have to spend too much time and energy analyzing them. The words which should be included are those which are most common to children's speaking vocabulary, those which are most frequently encountered in printed material, those which are generally most difficult to learn and those which particular children cannot remember.

Contextual Analysis

As well as being a decoding method in its own right, contextual analysis is the overseer of visual memory, phonic analysis and structural analysis. Consequently, contextual analysis is a skill that should be developed alongside the other word recognition skills. Essentially through the development of this skill, the child should learn to determine whether a particular word makes sense in a sentence in terms of three criteria: (1) whether the word fits grammatically with the rest of the sentence, (2) whether the word fits semantically with the sentence, and (3) whether it fits the phonic, syllabic and/or morphemic clues presented by the word itself.

(Adapted from May and Eliot, 1978,
pp. 27-35, 110-127)

LANGUAGE AND READING

A clear relationship between the language and meaning of the text, and the children's own language and knowledge makes material predictable. The more reading material reflects the whole and intensely meaningful language children use already, the more proficiently will they apply their accumulated language knowledge and world view to the construction of meaning. In the process of constructing meaning, readers make use of the three language systems: graphophonic, syntactic, and semantic.

Graphophonic System

The graphophonic system refers to the relationships between the sounds of language, and the written form of language. Contrary to a good deal of popular opinion, the English spelling system is quite regular and not at all haphazard. However, there is no simple one-to-one correspondence between the written language and the sound system. There are language features that exist in written language and do not exist in the oral language. "Once upon a time," frequently found in storybooks, is seldom used in oral language except in storytelling. Clauses such as "said Mother" or "John laughed" preceded or followed by a quotation are common in written language, even in beginning reading material, yet are not frequent in oral language at all. In addition, there are other influences that do not permit a one-to-one relationship between written and oral language.

Because of its long and complex history, as well as influences from several other languages, the English spelling system has more than one spelling pattern that relates to the same sounds. Examples include "ai" as in "bait" and "a-e" as in hate. Although English is to a large extent spelled in a standard way, there are different ways to pronounce the same written words. To some speakers of English Mary, merry, and marry are homophones—pronounced exactly the same. For other speakers only two of those three words are homophones, and for still others all three words are pronounced differently.

Because the purpose of reading is to comprehend the meaning of the author, readers in addition to using the graphophonic system also use the syntactic and semantic systems to build the relationships between the sounds of language and written language.

Syntactic System

The phrase syntactic system refers to the interrelationships of words, sentences, and paragraphs. It includes the interrelationships of word order, tense, number, and gender. Grammar is the more common term for syntax. All children can use the rules of their own grammar system rather proficiently by the time they come to school. When five-year-olds are asked to complete the sentence "A boy is sliding down the ________," they will always apply some acceptable noun or noun phrase at the end of the sentence. They will not be able to call the word they supply a noun or know the definition of noun; nevertheless they know where nouns go in English sentences. The terms syntax or grammar refer not to the rules imposed on the language by grammar books but to the rules people know intuitively by virtue of being language users.

The syntax of written material provides significant cues for readers. They are able to ask, "Does this sound like language to me?"

They can use syntax to predict and then to confirm the acceptability of their predictions. But in order to comprehend, they must also have the semantic system available.

Semantic System

The semantic system is at the heart of the language. It includes the relationships within a language that establish meaning for the user. Everything that the user has been learning and thinking about the world is also involved in establishing meaning.

People who live in apartments, trailers, or box cars that are secure, warm, familiar places have established the various meanings of house and home through their own living experiences and their use of language in various real-life settings. Regardless of where they have lived, they have said to others, "Come over to my house after school today." "Take this home to your mother." They may therefore have difficulty with lessons that try to explain the traditional meanings of house and home or may not understand why a poet would rhapsodize, "It takes a heap of living to make a house a home." The closer the content of reading material is to the life and experiences of the students, and the closer the concepts of reading material are to what students already know, the easier it is for them to understand the meaning relationship in the reading material.

At the same time, reading must expand students' knowledge and view of the universe. If the material to be read has many known concepts along with some unknowns, readers can use what they know in order to understand better the unknown content or concepts. Therefore, in order to provide opportunities for expansion of experiences and broadening of concepts, teachers should encourage students to read material that involves some unique experiences and that is to some degree beyond their own knowledge. However, if too many of the experiences or concepts are foreign, the reading will be nonsense to them.

Integration of the Systems

Only when the semantic cueing system is available, in addition to the syntactic and graphophonic systems, is there the necessary support for meaningful reading. Readers can then predict and confirm language experiences based on graphophonic and syntactic information and can make intelligent predictions and confirmations because they have the necessary semantic information available. In addition, they can integrate what they are reading with what they know in order to comprehend.

When we add semantic meaning to the examples of spelling patterns presented earlier (Mary, merry, marry), we can examine the significance of these.

Mary ran to the store quickly.
The man and the woman want to marry.
Jeff sees a merry clown.

Clearly the more context available to the reader, the more support there is for understanding and comprehension.

(Adapted from Goodman and Burke, 1980, pp. 10-13)

THE FUNCTIONS OF LANGUAGE

The term function is defined as the means by which a purpose is achieved. The purpose that language serves is that of expressing and constructing meanings. Through the examination of children's thinking, four primary ideational functions of language can be recognized. These are the directive, interpretive, projective and relational functions.

Directive Function

The directive function is concerned with directing actions and operations. At its simplest level it is a running commentary on actions as they are performed, and at its most complex it is concerned with the actions of the self and others in planning and co-ordinating a sequence of actions or operations.

In the realization of this function two uses of language emerge: self directing and other directing. Prominent in the self-directing of language is talk that is monitoring the child's own action. This is usually indicated by a running commentary or monologue, which appears to keep the child aware of the actions he is performing. The directive function is evident when language is used for directing the actions of others. This is usually accomplished through demonstrating and instructing.

The Interpretive Function

If a large part of the child's language is concerned with his own action and activities, there is another component that is a reflection of the interpretation that the world has for him. Two uses of language serve the interpretive function: reporting and reasoning. Reporting serves to identify objects and events that the child encounters. In this sense language is used to represent items and events that the child observes and tends to indicate what aspects of the world around him the child considers important. The use of language for reasoning develops from reporting in which attention is given to several aspects of the situation to be discussed. The child uses this component of language to impose order on the events which make up experience. Essentially the interpretive function of language helps the child deal with the world outside himself and reflects his ability to scan, analyse, and recognize relationships and impose some order on the events which comprise his experiences.

Projective Function

The third of the ideational functions that language appears to serve is the projective function. This function is concerned with the organization of meaning for events that have not yet occurred, and which may never take place. Essentially, the projective function involves the extension of thought beyond immediate or personal experience. Three uses of language are related to the projective function: the predictive, empathic and imaginative use. Predicting involves projecting beyond the present experience and employs strategies that of necessity anticipate events in the future or project into events that are not part of direct experience. These strategies include forecasting, anticipating consequences, surveying possible alternatives, recognizing problems and predicting solutions.

The empathetic use of language is concerned with imagining and expressing the feelings and reactions of other people to their experiences. Compared to both the predictive and empathic uses of language, the imaginative use is utilized the most frequently by young children. This is most noticeable in children's representational play. For instance, children pick up materials or objects and rename them, pieces of wood become boats, boxes become buildings, and sticks become guns. The child renames the material and by his actions indicates that he is regarding the material as a symbol for the actual.

Relational Function

The purpose of this aspect of language is to establish, maintain and convey relationships between people.

All children have needs, both physical and psychological. These needs are made explicit through the self-maintaining use of language. Expression of need, protection of self interest and justification are the kind of strategies that the child will use in an attempt to make others aware of him as a person and his needs. Other strategies such as criticism and threats are aimed at maintaining the child's status with others. Language that reflects the interactional nature of the assumed relationships, the way in which an approach is made and the way the approach is received, encompasses the interactional use. The expression of these assumed relationships may determine the kind of interaction that takes place. The strategies that may be used will range from self-emphasizing strategies that centre on the speaker's view of the situation as in "Give me the car, it's mine" to other-recognizing strategies that clearly take into account the other person's point of view (e.g., "Would you like to give me my car back now, because I'm going home.").

Four aspects of language, the relational, directive, interpretative and projective functions, have been outlined. Although this classification may not be exhaustive it can provide us with a set of descriptions of language that can be used in comparing the language used by different children.

(Adapted from Tough, 1977, pp. 45-69.)

THE DEVELOPMENT OF THINKING

Piaget believes that the child's intellectual growth is characterized by a series of stages: sensori-motor, preoperational, concrete operational and formal operational thought. These stages represent general descriptions of how children at different ages interact with their environment.

Sensori-Motor Thought

During the first two years of life the child is making enormous cognitive strides. At birth the infant exhibits a limited range of uncoordinated reflexes which are a necessary condition for any subsequent development. The first four months show the start of adaptation. Initially the infant's adaptive action may be a chance matter but it will be repeated until gradually a new cognitive structure or scheme develops. This process is known as a circular reaction. In the early months primary circular reactions enable the child to move from the reflex sucking scheme to the more differentiated scheme of sucking his fingers, or from seeing and touching an object separately to grasping an object he can see.

Between four and eight months the secondary circular reactions develop to the point in which the infant is able to act upon his environment in an instrumental way. For example, he can cause interesting sounds or sights to recur or be maintained. These secondary circular reactions then become co-ordinated to form more complex schemes and intentionality begins to develop. For instance, the child begins to search for hidden objects and becomes more interested in new things just because they are new.

During the latter part of this stage the child moves from this logic of action to representing events which are not perceptually present. He moves from overt physical actions to covert internalized actions which are called pre-operations. At this point the child becomes capable of thinking about doing X rather than actually performing the physical manipulations. The sensori-motor stage ends when the infant is able to represent what he knows symbolically so that what he knows is no longer tied to what he does. To be able to think symbolically means that the child can represent an event in his mind and internally reflect upon it.

Preoperational Thought

The second broad period of intellectual development is the preoperational stage. In the preoperational period the child begins to use mental symbols (images or words) that stand for or represent objects that are not present. Some examples are found in the child's play: his bicycle may be an airplane, a box becomes a house, and a piece of cloth is used as a robe. The use of symbols is also seen in deferred imitation, that is, imitation of a model that is no longer present.

During the early part of this stage, the child is egocentric and centered about himself. He is unable to take another person's point of view. Furthermore, the concepts of the preoperational child and his understanding of situations are likely to be determined by his immediate perceptions and often he perceives only a single salient aspect of a particular object or event. Consequently the child may

may have no real conception of abstract principles that guide classification and seriation.

The Stage of Concrete Operations

During this period the deficiencies of the preoperational period are, to a large extent, overcome. The child acquires the concept of conservation and becomes more aware of the principle of invariance. Furthermore, he acquires the concept of reversibility or the idea that in thoughts steps can be retraced, actions can be cancelled, and the original situation can be restored.

The operational child also succeeds in other tasks where preoperational children fail. He has a more advanced notion of classes in an abstract sense, and he can sort objects on the basis of such characteristics as shape, color and size. He also understands relationships between classes and subclasses, and can recognize that an object can belong to both classes simultaneously.

The cognitive achievements of the stage of concrete operations make the child's thought much more solid and flexible than it was earlier. He is capable of elementary logical processes, or operations, and reasoning deductively from premise to conclusion. However, he does so in limited and elementary ways, applying logic only to concrete events and representations of these.

Formal Operations

Dealing with verbal expressions of logical relationships requires "formal operations" as distinct from "concrete operations," and children do not ordinarily use these until the age of eleven or twelve. The application of logical rules and reasoning to abstract problems and propositions is the essence of mature intellectual ability. The adolescent can reason deductively, making hypotheses about problem solutions, and hold many variables in mind simultaneously. He is capable of scientific reasoning and of formal logic, and he can follow the form of an argument while discarding its concrete content.

In contrast with the operational child who is concerned only with concrete objects and representations of these, the adolescent seems preoccupied with thinking. He takes his own thought as an object and thinks about thinking, evaluating his own and others' logic, ideas and thoughts. He considers general laws as well as real situations, and he is concerned with the hypothetically possible as well as reality. His dependence on the perception or manipulation of concrete objects is greatly reduced; he need no longer confine his attention to the immediate situation. By the time he is fifteen, the adolescent solves problems by analyzing them logically and formulating hypotheses about possible outcomes that might occur. The hypotheses may be complex ones involving many possible combinations of outcomes. Nevertheless, the individual who has attained the stage of formal operations attempts to test these hypotheses either mentally or in reality by experiments.

(Adapted from Mussen, 1973, pp. 31-36.)

APPENDIX B

READING MATERIAL, P1, P2, P3, P4, Pr1, Pr2

THE FUNCTIONS OF LANGUAGE (P1)

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Directive Function

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In the realization of this function two uses of language emerge: self-directing and other-directing. Prominent in the self-directing of language is talk that is monitoring the child's own action. This is usually indicated by a running commentary or monologue, which appears to keep the child aware of the actions he is performing. The other directive function is evident when language is used for directing the actions of others. This is usually accomplished through demonstrating and instructing.

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If a large part of the child's language is concerned with his own action and activities, there is another component that is a reflection of the interpretation that the world has for him. Two uses of language serve the interpretive function: reporting and reasoning. Reporting serves to identify objects and events that the child encounters. In this sense language is used to represent items and events that the child observes and tends to indicate what aspects of the world around him the child considers important. The use of language for reasoning develops from reporting in which attention is given to several aspects of the situation to be discussed. The child uses this component of language to impose order on the events which make up experience. Essentially the interpretive function of language helps the child deal with the world outside himself and reflects his ability to scan. analyse, and recognize relationships and impose some order on the events which comprise his experiences.

Projective Function

The third of the ideational functions that language appears to serve is the projective function. This function is concerned with the organization of meaning for events that have not yet occurred, and which may never take place. Essentially, projective functioning involves the extension of thought beyond immediate or personal experience. Three uses of language are related to the projective function: the predictive, empathetic and imaginative use. Predicting involves projecting beyond the present experience and employs strategies that of necessity anticipate events in the future or project into events that are not part of direct experience. These strategies include forecasting, anticipating consequences, surveying possible alternatives, recognizing problems and predicting solutions. The empathetic use of landugage is concerned with imagining and expressing the feelings and reactions of other people to their experiences. Compared to both the predictive and empathic uses of language, the imaginative use is utilized the most frequently by young children. This is most noticeable in children's representational play. For instance, children pick up materials or objects and rename them, pieces of wood become boats, boxes become buildings, and sticks become guns. The child renames the material and by his actions indicates that he is regarding the material as a symbol for the actual.

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Dealing with verbal expressions of logical relationships requires "formal operations" as distinct from "concrete operations," and children do not ordinarily use these until the age of eleven or twelve. The application of logical rules and reasoning to abstract problems and propositions is the essence of mature intellectual ability. The adolescent can reason deductively, making hypotheses about problem solutions, and hold many variables in mind simultaneously. He is capable of scientific reasoning and of formal logic, and he can follow the form of an argument while discarding its concrete content.

In contrast with the operational child who is concerned only with concrete objects and representations of these, the adolescent seems preoccupied with thinking. He takes his own thought as an object and thinks about thinking, evaluating his own and others' logic, ideas and thoughts. He considers general laws as well as real situations, and he is concerned with the hypothetically possible as well as reality.

(Adapted from Mussen, 1973, pp. 31-36)

KINDS OF VARIANCE (P3)

To obtain answers to research questions, and to test hypotheses, different kinds of variance are compared. These forms of variance are population and sample variance, systematic variance, between-group variance and error variance.

Population and Sample Variances

Population variance is the measure of U, a universe of population of measures. If all the measures of a defined universal set, U, are known, then the variance is known. More likely, however, all the measures of U are not available. In such cases the variance is estimated by calculating the variance of one or more samples of U. A good deal of statistical energy goes into this important problem. A question may arise: How variable is the intelligence of the citizens of Canada? This is a U or population question. If there were a complete list of all the millions of people in Canada, and there were also a complete list of intelligence test scores of these people—the score variance could be simply if wearily computed. No such list exists. So samples—hopefully representative samples—of Canadians are tested and means and score variances computed. The samples are used to estimate the mean and variance of the whole population.

Sampling variance is the variance of statistics computed from samples. The means of four random samples drawn from a population will differ. If the sampling is random and the samples are large enough, the means should not vary too much. That is, the variance of the means should be relatively small.

Systematic Variance

Perhaps ~~the~~ most general way to classify variances is as systematic variance. Systematic variance is the variation in measures due to some known or unknown influences that "cause" the scores to lean in one direction more than another. Any natural or man-made influences that cause events to happen in a certain predictable way are systematic influences. The achievement test scores of the children in a wealthy suburban school will tend to be systematically higher than the achievement test scores of the children in a city slum area school. Expert teaching may systematically influence the achievement of children—as compared to the achievement of children taught inexpertly.

There are many, many causes of systematic variance. The scientist seeks to separate those in which he is interested from those in which he is not interested. Additionally he must attempt to separate from his systematic variances, variance that is random. Indeed, research may narrowly and technically be defined as the controlled study of variances.

Between-Groups (Experimental) Variance

One important type of systematic variance in research is between-groups or experimental variance. Between-groups or experimental variance, as the name indicates, is the variance that reflects systematic differences between groups of measures. The variance discussed previously, score variances, reflects the differences between individuals in a group. We can say, for instance, that, on the basis of present evidence and current tests, the variance in intelligence of a random sample of eleven-year-old children is about 225 IQ points.

This figure is a statistic that tells us how much the individuals differ from each other. Experimental variance, on the other hand, is the variance due to the differences between groups of individuals. It is often called "between-groups" variance. If the achievement of urban and rural children in comparable schools is measured, there would be differences between the urban and rural groups. Groups as well as individuals differ or vary, and it is possible and appropriate to calculate the variance between these groups.

Error Variance

It is probably safe to say that the most ubiquitous kind of variance in research is error variance. Error variance is the fluctuation or varying of measures due to chance. Error variance is random variance. It is the variation in measures due to the usually small and self-compensating fluctuations of measures—now here, now there; now up, now down.

It can be said that error variance is the variance in measures due to ignorance. Imagine a great dictionary in which everything in the world—every occurrence, every event, every little thing, every great thing—is given in complete detail. To understand any event that has occurred, that is now occurring, or that will occur, all one needs to do is look it up in the dictionary. With this dictionary there are obviously no random or chance occurrences. Everything is accounted for. In brief, there is no error variance; all is systematic variance. Unfortunately—or more likely fortunately—we do not have such a dictionary. Many, many events and occurrences cannot be explained. Much variance eludes identification and control. This is error variance—at least as long as identification and control elude us.

(Adapted from Kerlinger, 1973, pp. 73-80)

TYPES OF LEARNING (P4)

Although individuals utilize many forms of learning, the four types most prominent, particularly in the construction of higher level cognitions, are discrimination learning, concept learning, rule learning and problem solving.

Discrimination Learning

In discrimination learning the individual learns to make "n" different identifying responses to as many different stimuli, which may resemble each other in physical appearance to a greater or lesser degree. Although the learning of each stimulus-response (Ss-R) connection is a simple example of stimulus-response learning, the connections tend to interfere with retention, particularly if the discriminative aspects of the chain have not been internalized.

To illustrate: When an individual acquires a chain that makes it possible for him to say alumette to "match," and then goes on to learn to say fromage for "cheese," he may by so doing weaken the first chain; he may forget the French word for "match." If he tries to learn four French words at once, rather than two, the process will be more than twice as difficult; six at once will be more than three times as difficult; and so on. Increasing the number to be learned does not change the basic nature of the learning process, but it highlights the effects of another process—forgetting. Consequently, to inhibit memory loss in discrimination learning, individual chains connecting each distinctive stimulus with each identifying response must be thoroughly internalized by the individual.

Concept Learning

Through concept learning the individual's behaviour comes to be controlled, not by particular stimuli that can be identified in specific physical terms, but by abstract properties of such stimuli. As an example, we may consider how a child learns the concept middle. Initially, he may have been presented with a set of blocks arranged like this: ■ ■ ■. If previous Ss-R learning has enabled him to receive reinforcement for a request such as "Give me a block," he can then readily learn the simple chain of picking up the middle block when his parent says, "Give me the middle one." Similar chains can then be established with other objects, such as balls arranged in the same configuration ● ● ●, or sticks ▮ ▮ ▮.

Adults, because of treater language facility, need not learn new concepts in the manner previously described. If an adult does not happen to know what middle means he may learn it by acquiring a chain linking this word with another concept he already knows, such as in between.

Rule Learning

A rule expresses the relationship between two or more concepts. In a formal sense a rule is a chain of two or more concepts. Rule learning is examplified by the acquisition of the "idea" contained in such propositions as "gases expand when heated"; and "the pronoun 'each' takes a singular verb." Human beings must learn large numbers of such rules, from simple ones to highly complex ones.

Although the possibility exists that these rules can be learned as simple verbal chains, doing so would result in limited generalizability and application of the rule. Referring to our previous example "the pronoun 'each' takes a singular verb" the only kind of performance that would be possible following such learning would be verbatim recall.

Problem Solving

Once the human being has acquired some rules, he can use them for many purposes in dealing with and controlling his environment. The individual can combine the rules he has already learned into a great variety of novel higher-order rules. He may do this by stimulating himself and also be responding to various forms of stimulation from his environment. By means of the process of combining old rules into new ones, he solves problems that are new to him and thus acquires a still greater store of new capabilities.

To solve a problem the learner must be able to identify the essential features of the response that will be in the solution before he arrives at the solution. This goal orienting condition appears to be important because of the lengthy chain involved in the process. Then the necessary rules which have been previously learned are recalled and are combined so that a new rule emerges and is learned.

The occurrence of problem solving events are likely to occur to a greater or lesser degree in most daily activities. When an individual maps his route through traffic (as opposed to simply being swept along by it), he is solving a problem. This is further exemplified by the problems that are solved by students in composing reports and themes, in marshalling arguments to present a point of view, and in performing laboratory experiments.

(Adapted from Gagné, 1970, pp. 47-64)

THE SCIENTIFIC PROCESS (Pr 1)

The scientific process is a naturally occurring part of our lives. In addition to this feature, science is characterized by a search for regularity, observation, and information processing.

Search for Regularity

The first and probably most important feature of the scientific process is the search for regularities. A regularity is a pattern that has occurred in the past and can be expected to occur again in the future. The world is full of regularities such as: the sun rises in the east and like poles of a magnet repel while unlike poles attract.

Defining science as a search for regularity implies a dual nature of science. On the one hand science is a search, which implies a continuing activity. This is the process aspect of science; in the search for regularities, people engage in certain processes, such as observing and inferring. The other dimension of science is the product or content of that search—the facts, concepts, and generalizations that scientists have formed. One way to distinguish between process and product is to think of the process dimension as the doing component of this process. While the actual forming of regularities involves the process nature of science, the regularities once formed refer to the product or content of science.

Science as a Naturally Occurring Part of Our Lives

Science is a naturally occurring phenomenon and people often act as scientists without even knowing it. For example, shoppers will often go to several stores, stopping at each for particular items.

Through their experience they learn that certain stores have better produce, others have better meats, and still others have cheaper canned goods. These conclusions are reached through observations the people make as they shope. From these observations, regularities are formed which are used to guide future shopping behaviour.

A person is also doing science, for example, when he or she varies a recipe slightly and notes the changes in the final product. It also occurs when someone attempts to change his or her behaviour and watches what effect this new behaviour has on other people, or when a teacher uses a new teaching technique and observes what effect this technique has on student performance. All these people are attempting to find patterns in their world by shaping their observations into recognizable forms.

Science is Based on Observable Data

So far we have said science is an attempt to form patterns, and it is a natural activity for people. A third characteristic is that the regularities formed are based upon observable data. This is in contrast to nonscientific activities in which people form conclusions on the basis of opinions, feelings, superstitions, or authority.

For instance, historically, people described illnesses in terms of evil spirits. These people were not involved in the process of science, because their conclusions were based on superstition rather than on observable data. Later, when people formed the generalization, "Disease is caused by bad air," the process they followed could be considered scientific, even though this belief is not currently accepted. The regularity formed was based upon the evidence that closing the window at night prevented the sickness. From this observation they concluded that sickness was sometimes caused by the air itself. In time, however, the idea of humours became harder and harder to accept because it failed to explain these other observations: mosquito netting prevents malaria, physically fit people are less susceptible to disease than unfit people, and people who keep themselves clean are sick less often than their dirtier counterparts. Because the idea of humours was unable to account for all the observations, a new explanation was sought and the germ theory of disease was born.

Science is Information Processing

We have seen that science is characterized by a search for regularities or patterns based on observable data; in order for the process to be considered scientific, people must form the patterns on the basis of the information rather than on intuition or superstition. In doing so they take single items of information, summarize the information and transform it into regularities that are more usable than the isolated pieces themselves. This activity, called information processing, is a fourth major characteristic of science. For example, the statement "Disease is caused by bad air" was based on observations or information about how closing windows could prevent malaria. Information processing occurred when these separate observations were summarized in a generalization.

(Adapted from Kauchak and Eggen, 1980, pp. 3-15)

THE QUEST FOR EQUILIBRIUM (Pr 2)

Cognitive equilibrium is maintained through the processes of adaptation, accommodation, assimilation, and organization.

Adaptation

Adaptation is the individual's constant effort to understand the surrounding world through the processing of information. In doing this, the regularities already formed are often adequate. For example, if you looked up from this page to the room around you and saw familiar sights and objects, the regularities that you have would be adequate to describe or explain these sights. If something that you saw is out of place or strange (if there was an elephant in the room), then your mind would attempt to form an explanation to account for this discrepant information. Adaptation occurs when the individual interacts with the environment and either understands that environment (achieves a state of equilibrium) or tries to figure out why he or she does not.

Adaptation occurs through two complementing and reciprocal processes, assimilation and accommodation. Assimilation refers to the process of interpreting or viewing the external world according to structures (regularities that he already possesses). For example, when a small girl eyes a four-legged animal and says, "Doggie," she is assimilating the information she is receiving about the animal (four legs, brown and white fur) into her existing cognitive structure. Everything is fine for the child until the animal walks up to her and meows. Then accommodation must occur.

Accommodation

Accommodation refers to the processes of changing existing mental structures or patterns in response to the realities of the environment. Accommodation occurs when we learn something new, when we change our minds on a position because of new information, or when we change our attitudes about a person or groups of people because of experiences we have had. When accommodation takes place the content of our minds—concepts, generalizations, attitudes and views—changes to make them more in line with the real world around us. The young child encountering the animal had to do this when the "dog" meowed. According to past experience, dogs bark and don't meow. In attempting to reconcile or accommodate her mental structures or ideas with this new experience, she had two options: to conclude that dogs do indeed meow or to conclude that not all small, four-legged animals are dogs.

Assimilation

Assimilation involves the person's dealing with the environment in terms of his structures, while accommodation involves the transformation of his structures in response to the environment. Although conceptually distinct, these processes are simultaneously present in every act. To illustrate: suppose an infant of four months is presented with a rattle. The child has never before had the opportunity to play with rattles or similar toys. The rattle, then, is a feature of the environment to which he needs to adapt. The infant tries to grasp the rattle. In order to do this successfully he must accommodate. First, he must accommodate his visual activities to perceive the rattle correctly; then he must reach out and accommodate his movements to the distance between himself and the rattle; in grasping the rattle he must adjust his fingers to the shape; in lifting the rattle he must accommodate his muscular exertion to its weight. In sum, the grasping of the rattle involves a series of acts of accommodation, or modification of the infant's behavioural structures to suit the demands of the environment.

Grasping the rattle also involves assimilation. In the past the infant has already grasped things; for him, grasping is a well-formed structure of behaviour. When he sees the rattle for the first time he tries to deal with the novel object by incorporating it into a habitual pattern of behaviour. In a sense he tries to transform the novel object into something that he is familiar with, namely a thing to be grasped. We can say, therefore, that he assimilates the object into his framework.

Organization

The product of this process of adaptation is a new or modified organization. Essentially when we learn something new, we can say that the organization of our mind has changed. This change might consist of the addition of a new fact, concept, or generalization, or it could consist of the altering of an old regularity. For example, if a student who has previously thought of mammals as having four legs finds out that whales are mammals, the concept of mammal changes and a change in organization occurs. A new or modified structure results and some semblance of equilibrium returns to the cognitive system.

(Adapted from Kauchak and Eggen, 1980, pp. 53-58
and Ginsburg and Opper, 1969, pp. 18-19)

A

APPENDIX C

CLOZE READABILITY: INSTRUCTIONS, EXAMPLE PASSAGE AND FAMILIARITY QUESTIONS

I.D. NUMBER ______________________

Program of Studies ______________________ Major ____________________

Years of University Training _____________

INSTRUCTIONS

In this task you will be presented with six passages. Each passage will be preceded by a question, concerning topic familiarity. Please respond to the question before reading the passage.

The passages are incomplete in that certain words are omitted. While you are reading the selection, write in the blank the word which you think will make sense and best complete the passage. Complete the passages in order of presentation.

Upon completion of each passage inform me before continuing on to the next passage.

Please turn to the example passage and we will begin.

EXAMPLE PASSAGE

THE COMPOSITION OF AIR

For hundreds of years it was believed that air was a single substance, but it is now known that air is a mixture of several gases. ______________ common gases, nitrogen and ______________, make up about 99% ______________ the total volume of ______________. About 78% of the ______________ consists of nitrogen and ______________ 21% is oxygen. The ______________ consists of very small ______________ of carbon dioxide, hydrogen, ______________ ozone, and of the ______________ gases neon, krypton, helium ______________ xenon. Besides these gases, ______________ contains water vapour and ______________ small particles of solid ______________. The particles most commonly found in air are salt from the sea, dust from the earth, microbes, and the pollen grains and spores produced by plants.

(Sack and Yourman, 1971, p. 80)

ORIGINAL PASSAGE

THE COMPOSITION OF AIR

For hundreds of years it was believed that air was a single substance, but it is now known that air is a mixture of several gases. Two common gases, nitrogen and oxygen, make up about 99% of the total volume of air. About 78% of the air consists of nitrogen and nearly 21% is oxygen. The remainder consists of very small quantities of carbon dioxide, hydrogen, and ozone, and of the rare gases neon, krypton, helium, and xenon. Besides these gases, air contains water vapour and many small particles of solid matter. The particles most commonly found in air are salt from the sea, dust from the earth, microbes, and the pollen grains and spores produced by plants.

(Sack and Yourman, 1971, p. 80.)

This is a passage about the composition of air. Briefly discuss how familiar you are with this topic. ____________________________

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This is a passage about the functions of language. Briefly discuss how familiar you are with this topic. ______________________________

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This is a passage about the development of thinking. Briefly discuss how familiar you are with this topic. ____________________________

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This is a passage about different kinds of variance. Briefly discuss how familiar you are with this topic________________________________

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This is a passage about different types of learning. Briefly discuss how familiar you are with this topic. ______________________________

This is a passage about the maintenance of cognitive equilibrium. Briefly discuss how familiar you are with this topic.______

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This is a passage about the scientific process. Briefly discuss how familiar you are with this topic. ______________________________

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APPENDIX D

IDEA UNIT IDENTIFICATION: GRADUATE AND UNDERGRADUATE STUDENT INSTRUCTIONS AND UNDERGRADUATE STUDENT PRACTICE SESSION PASSAGE

INSTRUCTIONS: GRADUATE AND UNDERGRADUATE STUDENTS

I. D. NUMBER ________________

Program of Studies ______________________ Major ______________

Years of University Training _____________

INSTRUCTIONS

IDEA UNITS

Please read the passage and then divide the text into individual idea units by placing a vertical line at the division point.

An idea unit is defined as one which contains a complete thought and/or represents a pausal unit. (a place where a reader may pause)

UNDERGRADUATE STUDENT PRACTICE SESSION PASSAGE

DETERMINING AGE WITH RADIOCARBON

Carbon-14, also called radiocarbon is formed by the activity of cosmic rays on the earth's atmosphere. The more cosmic-ray activity, the more radiocarbon is formed. The less cosmic-ray activity, the less radiocarbon is formed.

Plants absorb radiocarbon from the atmosphere. When man eats plants, his body also absorbs radiocarbon. At death, the accumulation of radiocarbon in his body stops, and what is present continues to decay and is not replaced. In about 5,600 years the radiocarbon is thought to be half gone, it is therefore said to have a "half-life" of that time.

Thus, scientists take wood, charcoal, bone, or some other once-living object, and get an idea of its age by measuring the radioactive carbon present. If it is nearly half gone, the object is considered about 5,000 years old; nearly three-quarters gone, about 8,000 years old and so on. Items over 20,000 years old cannot be dated by this method.

(Sack and Yourman, 1971, p. 64)

APPENDIX E

IDEA UNIT RANKING: GRADUATE AND UNDERGRADUATE STUDENTS: INSTRUCTIONS, EXAMPLE PASSAGE AND CRITERIA FOR DETERMINING THE RANKING OF THE IDEA UNITS

INSTRUCTIONS

Ideа units differ in their importance to the central meaning of a passage, and can provide support to the essential meaning of the text to a greater or lesser degree. Essentially, units can be ranked in terms of whether they provide the most support (4), moderate support (3), little support (2), and minimal support (1), to the central meaning of the passage.

Please read the passage and assign each idea unit a ranking of 4, 3, 2, or 1.

4... Most support the central meaning
3... Moderate support to the central meaning
2... Little support to the central meaning
1... Minimal support to the central meaning

EXAMPLE PASSAGE

THE FATHER, HIS SON, AND THEIR DONKEY

A $\overset{4}{\text{father}}$ and his son/ were $\overset{4}{\text{taking}}$ their donkey to town/ to $\overset{3}{\text{sell}}$ him/ at $\overset{1}{\text{the}}$ marketplace./ They had not gone $\overset{1}{\text{a}}$ great distance,/ when they met a group $\overset{2}{\text{of}}$ pretty maidens/ who were $\overset{1}{\text{returning}}$ from the town./ The young girls were $\overset{1}{\text{talking}}$ and laughing/ when one of them $\overset{2}{\text{cried}}$ out, "Look there./ Did you ever $\overset{3}{\text{see}}$ such fools,/ to be walking alongside the donkey when they $\overset{4}{\text{might}}$ be riding it?"/ The father, $\overset{1}{\text{when}}$ he heard this,/ told his son to get $\overset{4}{\text{up}}$ on the donkey,/ and he continued to stroll $\overset{2}{\text{along}}$ merrily./

They traveled a little $\overset{1}{\text{further}}$ down the road,/ and soon came upon a group of $\overset{3}{\text{old}}$ men talking./ "There," said $\overset{1}{\text{one}}$ of them,/ "that proves what $\overset{2}{\text{I}}$ was saying./ What respect is shown to old age $\overset{4}{\text{these}}$ days?/ Do you see that idle young $\overset{4}{\text{boy}}$ riding the donkey,/ while his $\overset{4}{\text{father}}$ has to walk?/ You $\overset{2}{\text{should}}$ get down/ and let your $\overset{3}{\text{father}}$ ride!"/ Upon this the son got down $\overset{3}{\text{from}}$ the donkey/ and the father $\overset{4}{\text{took}}$ his place./

They had not gone far when they happened upon a group of women and children. "Why, you lazy old fellow, you should be ashamed," cried several women at once. "How can you ride upon the beast, when that poor little boy can hardly keep up with you?" So the good-natured father hoisted his son up behind him.

By now they had almost reached the town. "Tell me friend," said a townsman, "is that donkey your own?"

"Why yes," said the father.

"I would not have thought so," said the other, "by the way you overwork him. Why, you two are strong and are better able to carry the poor beast than he is to carry you."

"Anything to please you sir," said the father, "we can only try." So he and his son got down from the donkey. They tied the animal's legs together, and taking a pole, tried to carry him on their shoulders over a bridge that led to the marketplace. This was such an odd sight that crowds of people gathered around to see it, and to laugh at it. The donkey, not liking to be tied, kicked so ferociously that he broke the rope, tumbled off the pole into the water, and scrambled away into the thicket.

With this, the father and his son hung down their heads and made their way home again, having learned that by trying to please everybody, they had pleased nobody, and lost the donkey too.

CRITERIA AND EXAMPLES USED TO DETERMINE THE RANKING OF THE IDEA UNITS FOR THE GRADUATE STUDENTS

Level 4	5 or more participants must agree that the unit was a 4. Example: Idea Unit Number 3, P2: 4,4,4,4,4,3,4,4,3
Level 3	5 or more participants ranked the unit as a 3. Example: Idea Unit Number 28, P2: 3,3,3,3,3,3,3,3,2 or 5 or more participants ranked the unit as 3 and 4 combined. Example: Idea Unit Number 12, P2: 4,3,3,3,2,2,4,2,3
Level 2	5 or more participants ranked the unit as a 2. Example: Idea Unit Number 10, P3: 1,2,2,2,2,2,1,1,2 or 5 or more participants ranked the unit as a 2 and a 1 combined. Example: Idea Unit Number 25, P3: 2,3,1,2,1,3,1,1,2
Level 1	5 or more participants ranked the unit as a 1 Example: Idea Unit Number 52, P3: 1,1,1,2,2,2,1,1,1

CRITERIA AND EXAMPLES USED TO DETERMINE THE RANKING OF THE IDEA UNITS FOR THE UNDERGRADUATE STUDENTS

Level 4 7 or more participants must agree that the unit was a 4.

Example: Idea Unit Number 2, P4:
4,4,4,4,4,3,4,4,4,3,3,3

Level 3 7 or more participants ranked the unit as a 3.

Example: Idea Unit Number 14, P4:
3,3,3,3,3,3,4,3,3,3,2,4

or
7 or more participants ranked the unit as a 3 and 4 combined.

Example: Idea Unit Number 36, P3:
3,3,3,2,3,3,2,2,2,4,2,3

Level 2 7 or more participants ranked the unit as a 2.

Example: Idea Unit Number 24, P3:
2,2,2,3,3,2,2,2,2,3,2,3

or
7 or more participants ranked the unit as a 2 and 1 combined.

Example: Idea Unit Number 26, P3:
2,2,1,2,1,3,2,2,1,1,1,2

Level 1 7 or more participants ranked the unit as a 1.

No instances of this ranking occurred, however a hypothetical example would be:
1,2,1,2,1,1,2,1,1,2,1,3

APPENDIX F

PASSAGES P1, P2, P3, P4, IDEA UNITS AND IDEA UNIT RANKINGS

Most Support = M
Some Support = S
Little Support = L

THE FUNCTIONS OF LANGUAGE (P1)

		Ranking
1.	The term function is defined as the means by which a purpose is achieved.	S
2.	The purpose that language serves is that of expressing and constructing meanings.	M
3.	Through the examination of children's thinking, four primary ideational functions of language can be recognized.	M
4.	These are the directive, interpretive, projective and relational functions.	M
Directive Function		
5.	The directive function is concerned with directing actions and operations.	M
6.	At its simplest level it is a running commentary on actions as they are performed,	S
7.	and at its most complex it is concerned with the actions of the self and others in planning and co-ordinating a sequence of actions or operations.	S
8.	In the realization of this function two uses of language emerge:	S
9.	self-directing and other-directing.	M
10.	Prominent in the self-directing of language is talk that is monitoring the child's own action.	S
11.	This is usually indicated by a running commentary or monologue,	L
12.	which appears to keep the child aware of the actions he is performing.	L
13.	The other directive function is evident when language is used for directing the actions of others.	S
14.	This is usually accomplished through demonstrating and instructing.	S

		Ranking
The Interpretive Function		
15.	If a large part of the child's language is concerned with his own action and activities,	L
16.	there is another component that is a reflection of the interpretation that the world has for him.	L
17.	Two uses of language serve the interpretive function: reporting and reasoning.	M
18.	Reporting serves to identify objects and events that the child encounters.	S
19.	In this sense language is used to represent items and events that the child observes and tends to indicate what aspects of the world around him the child considers important.	S
20.	The use of language for reasoning develops from reporting in which attention is given to several aspects of the situation to be discussed.	S
21.	The child uses this component of language to impose order on the events which make up experience.	L
22.	Essentially the interpretive function of language helps the child deal with the world outside himself	S
23.	and reflects his ability to scan, analyse, and recognize relationships and impose some order on the events which comprise his experiences.	S
Projective Function		
24.	The third of the ideational functions that language appears to serve is the projective function.	S
25.	This function is concerned with the organization of meaning for events that have not yet occurred, and which may never take place.	M
26.	Essentially, projective functioning involves the extension of thought beyond immediate or personal experience.	S
27.	Three uses of language are related to the projective function: the predictive, empathetic and imaginative use.	S

		Ranking
28.	Predicting involves projecting beyond the present experience and employs strategies that of necessity anticipate events in the future or project into events that are not part of direct experience.	S
29.	These strategies include forecasting, anticipating consequences, surveying possible alternatives, recognizing problems and predicting solutions.	L
30.	The empathetic use of language is concerned with imagining,	S
31.	and expressing the feelings and reactions of other people to their experiences.	S
32.	Compared to both the predictive and empathic uses of language, the imaginative use is utilized the most frequently by young children.	L
33.	This is most noticeable in children's representational play.	L
34.	For instance, children pick up materials or objects and rename them, pieces of wood become boats, boxes become buildings, and sticks become guns.	L
35.	The child renames the material and by his actions indicates that he is regarding the material as a symbol for the actual.	L

Relational Function

36.	The purpose of this aspect of language is to establish, maintain and convey relationships between people.	M
37.	All children have needs, both physical and psychological.	L
38.	These needs are made explicit through the self-maintaining use of language.	S
39.	Expression of need, protection of self interest and justification are the kinds of strategies that the child will use in an attempt to make others aware of him as a person and his needs.	S
40.	Other strategies such as criticism and threats are aimed at maintaining the child's status with others.	S

	Ranking
41. Language that reflects the interactional nature of the assumed relationships, the way in which an approach is made and the way the approach is received, encompasses the interactional use.	S
42. The expression of these assumed relationships may determine the kind of interaction that takes place.	S
43. The strategies that may be used will range from self-emphasizing strategies that centre on the speaker's view of the situation as in "Give me the car, it's mine" to other-recognizing strategies that clearly take into account the other person's point of view (e.g. "Would you like to give me my car back now, because I'm going home.").	L

THE DEVELOPMENT OF THINKING (P2)

		Ranking
1.	Piaget believes that the child's intellectual growth is characterized by a series of stages:	M
2.	sensori-motor, preoperational, concrete operational and formal operational thought.	M
3.	These stages represent general descriptions of how children at different ages interact with their environment.	M
	Sensori-Motor Thought	
4.	During the first two years of life the child is making enormous cognitive strides.	M
5.	At birth the infant exhibits a limited range of uncoordinated reflexes	S
6.	which are a necessary condition for any subsequent development.	S
7.	The first four months show the start of adaptation.	S
8.	Initially the infant's adaptive action may be a chance matter	L
9.	but it will be repeated until gradually a new cognitive structure or scheme develops.	S
10.	This process is known as a circular reaction.	S
11.	In the early months primary circular reactions enable the child to move from the reflex sucking scheme to the more differentiated scheme of sucking his fingers,	S
12.	or from seeing and touching an object separately to grasping an object he can see.	S
13.	Between four and eight months the secondary circular reactions develop to the point in which the infant is able to act upon his environment in an instrumental way.	S
14.	For example, he can cause interesting sounds or sights to recur or to be maintained.	L
15.	These secondary circular reactions then become co-ordinated to form more complex schemes	S

		Ranking
16.	and intentionality begins to develop.	S
17.	For instance, the child begins to search for hidden objects	L
18.	and becomes more interested in new things just because they are new.	L
19.	During the latter part of this stage the child moves from this logic of action to representing events which are not perceptually present.	S
20.	He moves from overt physical actions to covert internalized actions which are called pre-operations.	S
21.	At this point the child becomes capable of thinking about doing X rather than actually performing the physical manipulations.	S

Preoperational Thought

22.	In the preoperational period the child begins to use mental symbols (images or words) that stand for or represent objects that are not present.	M
23.	Some examples are found in the child's play: his bicycle may be an airplane,	L
24.	a box becomes a house,	L
25.	and a piece of cloth is used as a robe.	L
26.	During the early part of this stage, the child is egocentric and centred about himself.	S
27.	He is unable to take another person's point of view.	S
28.	Furthermore, the concepts of the preoperational child and his understanding of situations are likely to be determined by his immediate perceptions	S
29.	and often he perceives only a single salient aspect of a particular object or event.	L
30.	Consequently the child may have no real conception of abstract principles that guide classification and seriation.	S

The Stage of Concrete Operations

		Ranking
31.	During this period the deficiencies of the preoperational period are, to a large extent, overcome.	M
32.	The child acquires the concept of conservation	M
33.	and becomes more aware of the principle of invariance.	S
34.	Furthermore, he acquires the concept of reversibility or the idea that in thoughts steps can be retraced, actions can be cancelled	M
35.	and the original situation can be restored.	S
36.	The operational child also succeeds in other tasks where preoperational children fail.	L
37.	He has a more advanced notion of classes in an abstract sense,	S
38.	and he can sort objects on the basis of such characteristics as shape, colour and size.	S
39.	He also understands relationships between classes and subclasses,	S
40.	and can recognize that an object can belong to both classes simultaneously.	S
41.	The cognitive achievements of the stage of concrete operations make the child's thought much more solid and flexible than it was earlier.	M
42.	He is capable of elementary logical processes, or operations,	S
43.	and reasoning deductively from premise to conclusion.	
44.	However, he does so in limited and elementary ways,	L
45.	applying logic only to concrete events and representations of these.	L

Formal Operations

46.	Dealing with verbal expressions of logical relationships requires "formal operations" as distinct from "concrete operations,"	M

		Ranking
47.	and children do not ordinarily use these until the age of eleven or twelve.	L
48.	The application of logical rules and reasoning to abstract problems and propositions is the essence of mature intellectual ability.	S
49.	The adolescent can reason deductively, making hypotheses about problem solutions,	S
50.	and hold many variables in mind simultaneously.	S
51.	He is capable of scientific reasoning and of formal logic,	S
52.	and he can follow the form of an argument while discarding its concrete content.	S
53.	In contrast with the operational child who is concerned only with concrete objects and representations of these,	S
54.	the adolescent seems preoccupied with thinking.	S
55.	He takes his own thought as an object and thinks about thinking,	S
56.	evaluating his own and others' logic, ideas and thoughts.	L
57.	He considers general laws as well as real situations, and he is concerned with the hypothetically possible as well as reality.	S

KINDS OF VARIANCE (P3)

		Ranking
1.	To obtain answers to research questions, and to test hypotheses, different kinds of variance are compared.	M
2.	These forms of variance are population and sample variance, systematic variance, between-group variance and error variance.	M

Population and Sample Variances

		Ranking
3.	Population variance is the variance of U, a universe or population of measures.	M
4.	If all the measures of a defined universal set, U, are known, then the variance is known.	S
5.	More likely, however, all the measures of U are not available.	L
6.	In such cases the variance is estimated by calculating the variance of one or more samples of U.	S
7.	A good deal of statistical energy goes into this important problem.	L
8.	A question may arise: How variable is the intelligence of the citizens of Canada?	L
9.	This is a U or population question.	L
10.	If there were a complete list of all the millions of people in Canada,	L
11.	and there were also a complete list of intelligence test scores of these people—	L
12.	the score variance could be simply if wearily computed.	L
13.	No such list exists.	L
14.	So samples—hopefully representative samples—of Canadians are tested and means and score variances computed.	L
15.	The samples are used to estimate the mean and variance of the whole population.	S

Ranking

16. Sampling variance is the variance of statistics computed from samples. M

17. The means of four random samples drawn from a population will differ. L

18. If the sampling is random and the samples are large enough, the means should not vary too much. L

19. That is, the variance of the means should be relatively small. L

Systematic Variance

20. Perhaps the most general way to classify variances is as systematic variance. S

21. Systematic variance is the variation in measures due to some known or unknown influences that "cause" the scores to lean in one direction more than another. M

22. Any natural or man-made influences that cause events to happen in a certain predictable way are systematic influences. L

23. The achievement test scores of the children in a wealthy suburban school will tend to be systematically higher than the achievement test scores of the children in a city slum area school. L

24. Expert teaching may systematically influence the achievement of children—as compared to the achievement of children taught inexpertly. L

25. There are many, many causes of systematic variance. L

26. The scientist seeks to separate those in which he is interested from those in which he is not interested. L

27. Additionally he must attempt to separate from his systematic variances, variance that is random. L

28. Indeed, research may narrowly and technically be defined as the controlled study of variances. L

Between-Groups (Experimental) Variance

29. One important type of systematic variance in research is between-groups or experimental variance. M

		Ranking
30.	Between-groups or experimental variance, as the name indicates, is the variance that reflects systematic differences between groups of measures.	M
31.	The variance discussed previously, score variances, reflects the differences between individuals in a group.	S
32.	We can say, for instance, that, on the basis of present evidence and current tests,	L
33.	the variance in intelligence of a random sample of eleven-year-old children is about 225 IQ points.	L
34.	This figure is a statistic that tells us how much the individuals differ from each other.	L
35.	Experimental variance, on the other hand, is the variance due to the differences between groups of individuals.	S
36.	It is often called "between-groups" variance.	S
37.	If the achievement of urban and rural children in comparable schools is measured,	L
38.	there would be differences between the urban and rural groups.	L
39.	Groups as well as individuals differ or vary,	L
40.	and it is possible and appropriate to calculate the variance between these groups.	L

Error Variance

41.	It is probably safe to say that the most ubiquitous kind of variance in research is error variance.	S
42.	Error variance is the fluctuation or varying of measures due to chance.	M
43.	Error variance is random variance.	S
44.	It is the variation in measures due to the usually small and self-compensating fluctuations of measures—now here, now there; now up, now down.	S
45.	It can be said that error variance is the variance in measures due to ignorance.	L

		Ranking
46.	Imagine a great dictionary in which everything in the world—every occurrence, every event, every little thing, every great thing—is given in complete detail.	L
47.	To understand any event that has occurred, that is now occurring, or that will occur, all one needs to do is look it up in the dictionary.	L
48.	With this dictionary there are obviously no random or chance occurrences.	L
49.	Everything is accounted for.	L
50.	In brief, there is no error variance; all is systematic variance.	L
51.	Unfortunately—or more likely, fortunately—we do not have such a dictionary.	L
52.	Many, many events and occurrences cannot be explained.	L
53.	Much variance eludes identification and control.	S
54.	This is error variance—at least as long as identification and control elude us.	S

TYPES OF LEARNING (P4)

		Ranking
1.	Although individuals utilize many forms of learning,	L
2.	the four types most prominent, particularly in the construction of higher level cognitions, are discrimination learning, concept learning, rule learning and problem solving.	M

Discrimination Learning

		Ranking
3.	In discrimination learning the individual learns to make "n" different identifying responses to as many different stimuli, which may resemble each other in physical appearance to a greater or lesser degree.	M
4.	Although the learning of each stimulus-response (Ss-R) connection is a simple example of stimulus-response learning,	S
5.	the connections tend to interfere with retention, particularly if the discriminative aspects of the chain have not been internalized.	S
6.	To illustrate: When an individual acquires a chain that makes it possible for him to say alumette to "match," and then goes on to learn to say fromage for "cheese," he may by so doing weaken the first chain;	L
7.	he may forget the French word for "match."	L
8.	If he tries to learn four French words at once, rather than two, the process will be more than twice as difficult;	L
9.	six at once will be more than three times as difficult; and so on.	L
10.	Increasing the number to be learned does not change the basic nature of the learning process,	S
11.	but it highlights the effects of another process—forgetting.	S
12.	Consequently, to inhibit memory loss in discrimination learning, individuals chains connecting each distinctive stimulus with each identifying response must be thoroughly internalized by the individual.	M

Concept Learning

		Ranking
13.	Through concept learning the individual's behaviour comes to be controlled,	M
14.	not by particular stimuli that can be identified in specific physical terms, but by abstract properties of such stimuli.	S
15.	As an example, we may consider how a child learns the concept middle.	L
16.	Initially, he may have been presented with a set of blocks arranged like this: ■ ■ ■.	L
17.	If previous Ss-R learning has enabled him to receive reinforcement for a request such as "Give me a block," he can then readily learn the simple chain of picking up the middle block when his parent says, "Give me the middle one."	L
18.	Similar chains can then be established with other objects, such as balls arranged in the same configuration ● ● ●, or sticks | | |.	L
19.	Adults, because of greater language facility, need not learn new concepts in the manner previously described.	S
20.	If an adult does not happen to know what middle means he may learn it by acquiring a chain linking this word with another concept he already knows, such as in between.	S

Rule Learning

		Ranking
21.	A rule expresses the relationship between two or more concepts.	M
22.	In a formal sense a rule is a chain of two or more concepts.	S
23.	Rule learning is exemplified by the acquisition of the "idea" contained in such propositions as "gases expand when heated"; and "the pronoun 'each' takes a singular verb."	S
24.	Human beings must learn large numbers of such rules, from simple ones to highly complex ones.	L

		Ranking
25.	Although the possibility exists that these rules can be learned as simple verbal chains, doing so would result in limited generalizability and application of the rule.	S
26.	Referring to our previous example "the pronoun 'each' takes a singular verb" the only kind of performance that would be possible following such learning would be verbatim recall.	L
	Problem Solving	
27.	Once the human being has acquired some rules, he can use them for many purposes in dealing with and controlling his environment.	S
28.	The individual can combine the rules he has already learned into a great variety of novel higher-order rules.	S
29.	He may do this by stimulating himself and also by responding to various forms of stimulation from his environment.	S
30.	By means of the process of combining old rules into new ones, he solves problems that are new to him and thus acquires a still greater store of new capabilities.	M
31.	To solve a problem the learner must be able to identify the essential features of the response that will be in the solution before he arrives at the solution.	M
32.	This goal orienting condition appears to be important because of the lengthy chain involved in the process.	S
33.	Then the necessary rules which have been previously learned are recalled and are combined so that a new rule emerges and is learned.	S
34.	The occurrence of problem solving events are likely to occur to a greater or lesser degree in most daily activities.	L
35.	When an individual maps his route through traffic (as opposed to simply being swept along by it), he is solving a problem.	L
36.	This is further exemplified by the problems that are solved by students in composing reports and themes, in marshalling arguments to present a point of view, and in performing laboratory experiments.	L

APPENDIX G

CLOZE PASSAGES, P1, P2, P3, P4, Pr1

THE FUNCTIONS OF LANGUAGE
(P1)

The term function is defined as the means by which a purpose is achieved. The purpose that language ______________ is that of expressing and constructing ______________. Through the examination of children's thinking, ______________ primary ideational functions of language can ______________ recognized. These are the directive, interpretive, ______________ and relational functions.

Directive Function

The directive function ______________ concerned with directing actions and operations. ______________ its simplest level it is a ______________ commentary on actions as they are ______________, and at its most complex it ______________ concerned with the actions of the ______________ and others in planning and co-ordinating ______________ sequence of actions or operations.

In ______________ realization of this function two uses ______________ language emerge: self-directing and ______________. Prominent in the self-directing of ______________ is talk that is monitoring the ______________ own action. This is usually indicated ______________ a running commentary or monologue, which ______________ to keep the child aware of ______________ actions he is performing. The directive ______________ is evident when language is used ______________ directing the actions of others. This ______________ usually accomplished through demonstrating and instructing.

The Interpretive Function

_______________ a large part of the child's _______________ is concerned with his own action _______________ activities, there is another component that _______________ a reflection of the interpretation that _______________ world has for him. Two uses _______________ language serve the interpretive function: reporting _______________ reasoning. Reporting serves to identify objects _______________ events that the child encounters. In _______________ sense language is used to represent _______________ and events that the child observes _______________ tends to indicate what aspects of _______________ world around him the child considers _______________. The use of language for reasoning _______________ from reporting in which attention is _______________ to several aspects of the situation _______________ be discussed. The child uses this _______________ of language to impose order on _______________ events which make up experience. Essentially _______________ interpretive function of language helps the _______________ deal with the world outside himself _______________ reflects his ability to scan, analyse, _______________ recognize relationships and impose some order _______________ the events which comprise his experiences.

Projective Function

_______________ third of the ideational functions that _______________ appears to serve is the projective _______________. This function is concerned with the _______________ of meaning for events that have _______________ yet occurred, and which may never

_______________ place. Essentially, projective functioning involves the _______________ of thought beyond immediate or personal _______________. Three uses of language are related _______________ the projective function: the predictive, empathetic _______________ imaginative use. Predicting involves projecting beyond _______________ present experience and employs strategies that _______________ necessity anticipate events in the future _______________ project into events that are not _______________ of direct experience. These strategies include _______________, anticipating consequences, surveying possible alternatives, recognizing _______________ and predicting solutions. The empathetic use _______________ language is concerned with imagining and _______________ the feelings and reactions of other _______________ to their experiences. Compared to both _______________ predictive and empathetic uses of language, _______________ imaginative use is utilized the most _______________ by young children. This is most _______________ in children's representational play. For instance, _______________ pick up materials or objects and _______________ them, pieces of wood become boats, _______________ become buildings, and sticks become guns. _______________ child renames the material and by _______________ actions indicates that he is regarding _______________ material as a symbol for the _______________.

Relational Function

The purpose of this aspect of _______________ is to establish, maintain and convey _______________ between people.

All children have needs, _______________ physical and psychological. These needs are ______________ explicit through the self-maintaining use of ______________. Expression of need, protection of self ______________ and justification are the kinds of ______________ that the child will use in ______________ attempt to make others aware of ______________ as a person and his needs. ______________ strategies such as criticism and threats ______________ aimed at maintaining the child's status ______________ others. Language that reflects the interactional ______________ of the assumed relationships, the way ______________ which an approach is made and ______________ way the approach is received, encompasses ______________ interactional use. The expression of these ______________ relationships may determine the kind of ______________ that takes place. The strategies that ______________ be used will range from self-emphasizing ______________ that centre on the speaker's view ______________ the situation as in "Give me ______________ car, it's mine" to other-recognizing strategies ______________ clearly take into account the other ______________ point of view (e.g. "Would you like to give me my car back now, because I'm going home.").

(Adapted from Tough, 1977, pp. 45-69.)

THE DEVELOPMENT OF THINKING
(P2)

Piaget believes that the child's intellectual growth is characterized by a series of stages: sensori-motor, preoperational, concrete operational and formal operational thought. These _______________ represent general descriptions of how children _______________ different ages interact with their environment.

Sensori-Motor Thought

_______________ the first two years of life _______________ child is making enormous cognitive strides. _______________ birth the infant exhibits a limited _______________ of uncoordinated reflexes which are a _______________ condition for any subsequent development. The _______________ four months show the start of _______________. Initially the infant's adaptive action may _______________ a chance matter but it will _______________ repeated until gradually a new cognitive _______________ or scheme develops. This process is _______________ as a circular reaction. In the _______________ months primary circular reactions enable the _______________ to move from the reflex sucking _______________ to the more differentiated scheme of _______________ his fingers, or from seeing and _______________ an object separately to grasping an _______________ he can see.

Between four and _______________ months the secondary circular reactions develop _______________ the point in which the infant _______________ able to act upon his environment _______________ an instrumental way. For example, he _______________ cause interesting sounds or sights to _______________ or to be maintained. These secondary _______________ reactions then become co-ordinated to form _______________ complex schemes and intentionality begins to _______________. For instance, the child begins to _______________ for hidden objects and becomes more _______________ in new things just because they _______________ new.

During the latter part of _______________ stage the child moves from this _______________ of action to representing events which _______________ not perceptually present. He moves from _______________ physical actions to covert internalized actions _______________ are called pre-operations. At this point _______________ child becomes capable of thinking about _______________ X rather than actually performing the _______________ manipulations.

Preoperational Thought

In the preoperational period the _______________ begins to use mental symbols (images _______________ words) that stand for or represent _______________ that are not present. Some examples _______________ found in the child's play: his _______________ may be an airplane, a box _______________ a house, and a piece of _______________ is used as a robe.

During _______________ early part of this stage, the _______________ is egocentric and centered about himself. _______________ is unable to take another person's _______________ of view. Furthermore, the concepts of _______________ preoperational child and his understanding of ______________ are likely to be determined by ______________ immediate perceptions and often he perceives ______________ a single salient aspect of a ______________ object or event. Consequently the child ______________ have no real conception of abstract ______________ that guide classification and seriation.

The Stage of Concrete Operations

During ______________ period the deficiencies of the preoperational ______________ are, to a large extent, overcome. ______________ child acquires the concept of conservation ______________ becomes more aware of the principle ______________ invariance. Furthermore, he acquires the concept ______________ reversibility or the idea that in ______________ steps can be retraced, actions can ______________ cancelled, and the original situation can ______________ restored.

The operational child also succeeds ______________ other tasks where preoperational children fail. ______________ has a more advanced notion of ______________ in an abstract sense, and he ______________ sort objects on the basis of ______________ characteristics as shape, colour and size. ______________ also understands relationships between classes and ______________, and can recognize that an object ______________ belong to both classes simultaneously.

The ______________ achievements of the stage of concrete ______________ make the child's thought much more ______________ and flexible than it was earlier. ______________ is capable of elementary logical processes, ______________ operations, and reasoning deductively from premise ______________ conclusion. However, he does so in ______________ and elementary ways, applying logic only ______________ concrete events and representations of these.

Formal Operations

______________ with verbal expressions of logical relationships ______________ "formal operations" as distinct from "concrete ______________," and children do not ordinarily use ______________ until the age of eleven or ______________. The application of logical rules and ______________ to abstract problems and propositions is ______________ essence of mature intellectual ability. The ______________ can reason deductively, making hypotheses about ______________ solutions, and hold many variables in ______________ simultaneously. He is capable of scientific ______________ and of formal logic, and he ______________ follow the form of an argument ______________ discarding its concrete content.

In contrast ______________ the operational child who is concerned ______________ with concrete objects and representations of ______________, the adolescent seems preoccupied with thinking. ______________ takes his own thought as an ______________ and thinks about thinking, evaluating his ______________ and others' logic, ideas and thoughts. He considers general laws as well as real situations, and he is concerned with the hypothetically possible as well as reality.

(Adapted from Mussen, 1973, pp. 31-36.)

KINDS OF VARIANCE
(P3)

To obtain answers to research questions, and test hypotheses, different kinds of variance are compared. _______________ forms of variance are population and _______________ variance, systematic variance, between-group variance and _______________ variance.

Population and Sample Variances

Population variance is the variance _______________ U, a universe or population of _______________. If all the measures of a _______________ universal set, U, are known, then _______________ variance is known. More likely, however, _______________ the measures of U are not _______________. In such cases the variance is _______________ by calculating the variance of one _______________ more samples of U. A good _______________ of statistical energy goes into this _______________ problem. A question may arise: How _______________ is the intelligence of the citizens _______________ Canada? This is a U or _______________ question. If there were a complete list _______________ all the millions of people in _______________, and there were also a complete _______________ of intelligence test scores of these _______________ — the score variance could be simply _______________ wearily computed. No such list exists. _______________ samples — hopefully representative samples — of Canadians _______________ tested and means and score variances _______________. The samples are used to estimate _______________ mean and variance of the whole _______________.

Sampling variance is the variance of _______________ computed from samples. The means of _______________ random samples drawn from a population _______________ differ. If the sampling is random _______________ the samples are large enough, the _______________ should not vary too much. That _______________, the variance of the means should _______________ relatively small.

Systematic Variance

Perhaps the most general _______________ to classify variances is as systematic _______________. Systematic variance is the variation in _______________ due to some known or unknown _______________ that "cause" the scores to lean _______________ one direction more than another. Any _______________ or man-made influences that cause events _______________ happen in a certain predictable way _______________ systematic influences. The achievement test scores _______________ the children in a wealthy suburban _______________ will tend to be systematically higher _______________ the achievement test scores of the _______________ in a city slum area school. _______________ teaching may systematically influence the achievement _______________ children — as compared to the achievement _______________ children taught inexpertly.

There are many, _______________ causes of systematic variance. The scientist _______________ to separate those in which he _______________ interested from those in which he _______________ not interested. Additionally he must attempt _______________ separate from his systematic variances, variance _______________ is random.

Indeed, research may narrowly ______________ technically be defined as the controlled ______________ of variances.

Between-Groups (Experimental) Variance

One important type of ______________ variance in research is between-groups or ______________ variance. Between-groups or experimental variance, as ______________ name indicates, is the variance that ______________ systematic differences between groups of measures. ______________ variance discussed previously, score variances, reflects ______________ differences between individuals in a group. ______________ can say, for instance, that, on ______________ basis of present evidence and current ______________, the variance in intelligence of a ______________ sample of eleven-year-old children is about ______________ IQ points. This figure is a ______________ that tells us how much the ______________ differ from each other. Experimental variance, ______________ the other hand, is the variance ______________ to the differences between groups of ______________. It is often called "between-groups" variance. ______________ the achievement of urban and rural ______________ in comparable schools is measured, there ______________ be differences between the urban and ______________ groups. Groups as well as individuals ______________ or vary, and it is possible ______________ appropriate to calculate the variance between ______________ groups.

Error Variance

It is probably safe to ______________ that the most ubiquitous kind of ______________ in research is error variance. Error

______________ is the fluctuation or varying of ______________ due to chance. Error variance is ______________ variance. It is the variation in ______________ due to the usually small and ______________ fluctuations of measures — now here, now ______________; now up, now down.

It can ______________ said that error variance is the ______________ in measures due to ignorance. Imagine ______________ great dictionary in which everything in ______________ world — every occurrence, every event, every ______________ thing, every great thing — is given ______________ complete detail. To understand any event ______________ has occurred, that is now occurring, ______________ that will occur, all one needs ______________ do is look it up in ______________ dictionary. With this dictionary there are ______________ no random or chance occurrences. Everything ______________ accounted for. In brief, there is ______________ error variance; all is systematic variance. ______________ — or more likely, fortunately — we do ______________ have such a dictionary. Many, many ______________ and occurrences cannot be explained. Much ______________ eludes identification and control. This is error variance — at least as long as identification and control elude us.

(Adapted from Kerlinger, 1973, pp. 73-80.)

TYPES OF LEARNING
(P4)

Although individuals utilize many forms of learning, the four types most prominent, particularly in the construction of higher level cognitions, are discrimination learning, concept learning, rule learning and problem solving.

Discrimination Learning

In ______________ learning the individual learns to make ______________ different identifying responses to as many ______________ stimuli, which may resemble each other ______________ physical appearance to a greater or ______________ degree. Although the learning of each ______________ (Ss-R) connection is a simple example ______________ stimulus-response learning, the connections tend to ______________ with retention, particularly if the discriminative ______________ of the chain have not been ______________.

To illustrate: When an individual acquires ______________ chain that makes it possible for ______________ to say alumette to "match," and ______________ goes on to learn to say ______________ for "cheese," he may by so ______________ weaken the first chain: he may ______________ the French word for "match." If ______________ tries to learn four French words ______________ once, rather than two, the process ______________ be more than twice as difficult; ______________ at once will be more than ______________ times as difficult; and so on. ______________ the number to be learned does ______________ change the basic nature of the ______________ process, but it highlights the effects ______________ another process — forgetting. Consequently, to inhibit ______________ loss in discrimination learning, individual chains ______________ each distinctive stimulus with each identifying ______________ must be thoroughly internalized by the ______________.

Concept Learning

Through concept learning the individual's behaviour ______________ to be controlled, not by particular ______________ that can be identified in specific ______________ terms, but by abstract properties of ______________ stimuli. As an example, we may ______________ how a child learns the concept ______________. Initially, he may have been presented ______________ a set of blocks arranged like ______________: ■ ■ ■ . If previous Ss-R learning has ______________ him to receive reinforcement for a ______________ such as "Give me a block," ______________ can then readily learn the simple ______________ of picking up the middle block ______________ his parent says, "Give me the ______________ one." Similar chains can then be ______________ with other objects, such as balls ______________ in the same configuration ● ● ● , or ______________ | | | .

Adults, because of greater language facility, ______________ not learn new concepts in the ______________ previously described. If an adult does ______________ happen to know what middle means ______________ may learn it by acquiring a ______________ linking this word with another concept ______________ already knows, such as in between.

Rule Learning

______________ rule expresses the relationship between two ______________ more concepts. In a formal sense ______________ rule is a chain of two ______________ more concepts. Rule learning is exemplified ______________ the acquisition of the "idea" contained ______________ such propositions as "gases expand when ______________"; and "the pronoun 'each' takes a ______________ verb". Human beings must learn large ______________ of such rules, from simple ones ______________ highly complex ones.

Although the possibility ______________ that these rules can be learned ______________ simple verbal chains, doing so would ______________ in limited generalizability and application of ______________ rule. Referring to our previous example "______________ pronoun 'each' takes a singular verb" ______________ only kind of performance that would ______________ possible following such learning would be ______________ recall.

Problem Solving

Once the human being has ______________ some rules, he can use them ______________ many purposes in dealing with and ______________ his environment. The individual can combine ______________ rules he has already learned into ______________ great variety of novel higher-order rules. ______________ may do this by stimulating himself ______________ also by responding to various forms ______________ stimulation from his environment. By means ______________ the process of combining old rules ______________ new ones, he solves problems that ______________ new to him and thus acquires ______________ still greater store of new capabilities.

______________ solve a problem the learner must ______________ able to identify the essential features ______________ the response that will be in ______________ solution before he arrives at the ______________. This goal orienting condition appears to ______________ important because of the lengthy chain ______________ in the process. Then the necessary ______________ which have been previously learned are ______________ and are combined so that a ______________ rule emerges and is learned.

The ______________ of problem solving events are likely ______________ occur at a greater or lesser ______________ in most daily activities. When an ______________ maps his route through traffic (as ______________ to simply being swept along by ______________), he is solving a problem. This is further exemplified by the problems that are solved by students in composing reports and themes, in marshalling arguments to present a point of view, and in performing laboratory experiments.

(Adapted from Gagne, 1970, pp.

THE SCIENTIFIC PROCESS
(Pr1)

The scientific process is a naturally occurring part of our lives. In addition to this ______________, science is characterized by a search ______________ regularity, observation, and information processing.

Search for Regularity

The ______________ and probably most important feature of ______________ scientific process is the search for ______________. A regularity is a pattern that ______________ occurred in the past and can ______________ expected to occur again in the ______________. The world is full of regularities ______________ as: the sun rises in the ______________ and like poles of a magnet ______________ while unlike poles attract.

Defining science ______________ a search for regularity implies a ______________ nature of science. On the one ______________ science is a search, which implies ______________ continuing activity. This is the process ______________ of science; in the search for ______________, people engage in certain processes, such ______________ observing and inferring. The other dimension ______________ science is the product or content ______________ that search — the facts, concepts, and ______________ that scientists have formed. One way ______________ distinguish between process and product is ______________ think of the process dimension as ______________ doing component of this process. While ______________ actual forming of regularities involves the ______________ nature of science, the regularities once ______________ refer to the product or content ______________ science.

Science as a Naturally Occurring Part of our Lives

Science is a naturally occurring ______________ and people often act as scientists ______________ even knowing it. For example, shoppers ______________ often go to several stores, stopping ______________ each for particular items. Through their ______________ they learn that certain stores have ______________ produce, others have better meats, and ______________ others have cheaper canned goods. These ______________ are reached through observations the people ______________ as they shop. From these observations, ______________ are formed which are used to ______________ future shopping behaviour.

A person is ______________ doing science, for example, when he ______________ she varies a recipe slightly and ______________ the changes in the final product. ______________ also occurs when someone attempts to ______________ his or her behaviour and watches ______________ effect this new behaviour has on ______________ people, or when a teacher uses ______________ new teaching technique and observes what ______________ this technique has on student performance. ______________ these people are attempting to find ______________ in their world by shaping their ______________ into recognizable forms.

Science is Based on Observable Data

So far we ______________ said science is an attempt to

_______________ patterns, and it is a natural _______________ for people. A third characteristic is _______________ the regularities formed are based upon _______________ data. This is in contrast to _______________ activities in which people form conclusions _______________ the basis of opinions, feelings, superstitions, _______________ authority.

For instance, historically, people described _______________ in terms of evil spirits. These _______________ were not involved in the process _______________ science, because their conclusions were based _______________ superstition rather than on observable data. _______________, when people formed the generalization, "Disease _______________ caused by bad air," the process _______________ followed could be considered scientific, even _______________ this belief is not currently accepted. _______________ regularity formed was based upon the _______________ that closing the window at night _______________ the sickness. From this observation they _______________ that sickness was sometimes caused by _______________ air itself. In time, however, the _______________ of humours became harder and harder _______________ accept because it failed to explain _______________ other observations: mosquito netting prevents _______________, physically fit people are less susceptible _______________ disease than unfit people, and people _______________ keep themselves clean are sick less _______________ than their dirtier counterparts. Because the _______________ of humours was unable to account _______________ all the observations, a new explanation _______________ sought and the germ theory of _______________ was born.

Science is Information Processing

We have seen that ______________ is characterized by a search for ______________ or patterns based on observable data; ______________ order for the process to be ______________ scientific, people must form the patterns ______________ the basis of the information rather ______________ on intuition or superstition. In doing ______________ they take single items of information, ______________ the information and transform it into ______________ that are more usable than the ______________ pieces themselves. This activity, called information ______________, is a fourth major characteristic of ______________. For example, the statement "Disease is ______________ by bad air" was based on ______________ or information about how closing windows ______________ prevent malaria. Information processing occurred when these separate observations were summarized in a generalization.

(Adapted from Kauchak and Eggen, 1980, pp. 3-15.)

APPENDIX H

APPLICATION COMPREHENSION QUESTIONS FOR PASSAGES P2, P3, P4 and Pr1 and Pr2

APPLICATION COMPREHENSION QUESTIONS FOR PASSAGES P2, P3, P4 and Pr1 AND Pr2

P2 Question	Discuss the extent to which the passage has contributed to your knowledge about the development of thinking.
P3 Question	Discuss the extent to which the passage has contributed to your knowledge about the different kinds of variance.
P4 Question	Discuss the extent to which this passage has contributed to your knowledge about the different types of learning.
Pr1 Question	Discuss the extent to which this passage has contributed to your knowledge about the scientific process.
Pr2 Question	Discuss the extent to which this passage has contributed to your knowledge of the child's quest for equilibrium?

APPENDIX I

CONDITION 3: EXAMPLE CLOZE PASSAGE

(Note: This example passage was only used if C3 preceded C4)

Example Passage

THE COMPOSITION OF AIR

For hundreds of years it was believed that air was a single substance, but it is now known that air is a mixture of several gases. Two common gases, nitrogen _______________ oxygen, make up about 99% of _______________ total volume of air. About 78% _______________ the air consists of nitrogen and _______________ 21% is oxygen. The remainder consists _______________ very small quantities of carbon dioxide, _______________, and ozone, and of the rare _______________ neon, krypton, helium, and xenon. Besides _______________ gases, air contains water vapor and _______________ small particles of solid matter. The particles most commonly found in air are salt from the sea, dust from the earth, microbes, and the pollen grains and spores produced by plants.

(Sack and Yourman, 1971, p. 80)

Original Passage

THE COMPOSITION OF AIR

For hundreds of years it was believed that air was a single substance, but it is now known that air is a mixture of several gases. Two common gases, nitrogen and oxygen, make up about 99% of the total volume of air. About 78% of the air consists of nitrogen and nearly 21% is oxygen. The remainder consists of very small quantities of carbon dioxide, hydrogen, and ozone, and of the rare gases neon, krypton, helium, and xenon. Besides these gases, air contains water vapour and many small particles of solid matter. The particles most commonly found in air are salt from the sea, dust from the earth, microbes, and the pollen grains and spores produced by plants.

(Sack and Yourman, 1971, p. 80.)